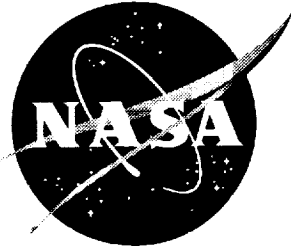


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Compendium of NASA Data Base for the Global Tropospheric Experiment's Pacific Exploratory Mission - Tropics B (PEM- Tropics B)

Volume 1: DC-8

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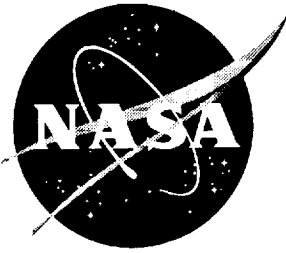
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COMPENDIUM OF NASA DATA BASE FOR THE
GLOBAL TROPOSPHERIC EXPERIMENT'S
PACIFIC EXPLORATORY MISSION – TROPICS B
(PEM-TROPICS B)

By A. Donald Scott, Jr., Mary M. Kleb, and James L. Raper
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SUMMARY

This report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Pacific Exploratory Mission – Tropics B (PEM-Tropics B) conducted in March and April 1999. The PEM-Tropics B mission provided the scientific community an opportunity to continue the investigation of tropospheric chemistry over the north and south tropical Pacific Oceans. Conducted during March and April 1999, PEM-Tropics B was an airborne study that complimented the PEM-Tropics A mission. It provided an opportunity to investigate chemical and transport properties of the tropical troposphere during contrasting meteorological conditions. PEM-Tropics B was conducted during the southern-tropical wet season when the influence from biomass burning observed in PEM-Tropics A was minimal. Major deployment sites were Hawaii, Kiritimati (Christmas Island), Tahiti, Fiji, and Easter Island. The broad goals of PEM-Tropics B were to improve understanding of the oxidizing power of the atmosphere and the processes controlling sulfur aerosol formation. In addition it was also an effort to continue to establish baseline values for chemical species that are directly coupled to the oxidizing power and aerosol loading of the troposphere.

PEM-Tropics B was conducted as part of the National Aeronautics and Space Administration's (NASA) Global Tropospheric Experiment (GTE). The GTE is an ongoing element of the Tropospheric Chemistry Program, a Research and Analysis

(R&A) program within the Science Division of NASA's Office for Earth Science Enterprise. PEM-Tropics B included measurements aboard NASA's DC-8 and P-3B aircraft. The major thrust of GTE has been to utilize NASA's DC-8 and P-3B aircraft to carry multi-instrument payloads into regions of the global troposphere where natural and/or human impacts are believed to be particularly significant in effecting chemical composition changes and/or where the troposphere is still relatively unaffected.

The format of this compendium utilizes data plots (time series) of selected data acquired aboard the NASA/Dryden DC-8 (vol. 1) and NASA/Wallops P-3B (vol. 2) aircraft during PEM-Tropics B. The purpose of this document is to provide a representation of aircraft data that will be available in archived format via NASA Langley's Distributed Active Archive Center (DAAC) or are available through the GTE Project Office archive. The data format is not intended to support original research/analyses, but to assist the reader in identifying data that are of interest. This compendium is for only the NASA aircraft data. The DAAC archived data bases will include numerous supporting data including meteorological observations/products, results from surface studies, satellite observations, and data from ozonesonde and rawin sonde releases.

INTRODUCTION

The goal of the NASA Tropospheric Chemistry Program is to develop an understanding of the chemical cycles that control the composition of the troposphere and to assess the susceptibility of the global atmosphere to chemical change. A major component of the NASA program is the **Global Tropospheric Experiment (GTE)**, which consists of a series of field experiments designed to (1) evaluate the capability of instrument techniques to measure, under field conditions, the minute concentrations of key chemical species in the troposphere; and (2) systematically address tropospheric chemistry issues relevant to global change, through airborne sampling expeditions, coupled with modeling and laboratory studies. GTE is primarily an aircraft-based program supplemented by ground-based measurements. Satellite data also play important roles. Space Shuttle observations of tropospheric carbon monoxide distributions have been used to plan and direct the course of expeditions, for example, over tropical rain forests and for continental outflow into the tropical Atlantic Ocean. LANDSAT land-surface images have facilitated the extrapolation of regional Arctic-tundra measurements into global-scale conclusions. **Total Ozone Measurements from Satellites (TOMS)** has helped place GTE observed ozone distributions/budgets into a global perspective (temporal and spatial) and has been used to guide intensive aircraft studies over the tropical Atlantic Ocean. Weather data returned by environmental satellites have guided flight planning for research flights. The **Distributed Active Archive Center (DAAC)** data include many of the satellite, surface, and meteorological products used to support GTE missions or analyses.

The GTE airborne expeditions have focused on studies of the remote global atmosphere in order to provide well-documented baseline measurements of the unperturbed environment and to fully understand the chemical cycles underlying the natural environment. Table 1 and Figure 1 summarize GTE missions conducted through 1999. The GTE expeditions have been conducted in a diverse range of environments and with different scientific goals. The **Chemical Instrument Test and Evaluation (CITE)** series was designed to study the ability to measure key tropospheric gaseous species by exposing selected instrumentation to a wide range of measurement conditions. The

Atmospheric Boundary Layer Experiments (ABLE) were designed to study the emission, chemical processes, and dynamics of the boundary layer, and have been conducted over ecosystems known to have significant influence on the global troposphere. The importance of long-range transport of natural and anthropogenic emissions on the global troposphere has been investigated in the Pacific Exploratory Missions (PEM) and the Transport and Atmospheric Chemistry near the Equator – Atlantic (TRACE-A). The Pacific Exploratory Missions in the Western Pacific Ocean (PEM-West) Phases A and B focused on the impact of emissions from the Asian continent over the northwest Pacific Ocean during contrasting meteorological conditions. The Pacific Exploratory Missions over the Tropical Pacific (PEM-Tropics) Phases A and B studied the oxidizing power of the atmosphere and sulfur chemistry over the Pacific basin also during contrasting seasons.

The GTE, managed as part of the Tropospheric Chemistry Program in the Mission to Planet Earth Office, NASA Headquarters, was initiated in the early 1980s. Implementation of the GTE Project is via a Project Office at the NASA Langley Research Center, Atmospheric Sciences Competency.

SYMBOLS AND UNITS

ABLE	Atmospheric and Boundary Layer Experiment
CITE	Chemical Instrument Test and Evaluation
DAAC	Distributed Active Archive Center
GTE	Global Tropospheric Experiment
ITCZ	Inter-Tropical Convergence Zone
LaRC	Langley Research Center
NASA	National Aeronautics and Space Administration
PEM	Pacific Exploratory Mission
ppbv	parts per billion, by volume
ppmv	parts per million, by volume

pptv	parts per trillion, by volume
SPCZ	South Pacific Convergence Zone
TOMS	Total Ozone Measurements from Satellites
TRACE-A	Transport and Atmospheric Chemistry near the Equator – Atlantic

PROGRAM AND DATA DESCRIPTION

The National Aeronautics and Space Administration's PEM-Tropics B mission, conducted in March and April 1999, was a major component of the Global Tropospheric Experiment, a project within the Earth Sciences Enterprise program. The long-range goal of the GTE is to contribute substantially to scientific understanding of human impacts on the chemistry of the global troposphere. Changes in chemical composition of the troposphere on a global scale have been well documented during these last two decades and have given rise to considerable concern that these chemical changes in the troposphere, which are expected to increase as population increases and economic activity expands, will lead to changes in the earth's climate. The PEM-Tropics B campaign had two main objectives, (1) Provide baseline data for chemical species that determine the oxidizing power and aerosol loading of the tropical Pacific, and (2) Evaluate the chemical and dynamic factors controlling ozone, OH, and aerosol levels over this remote region. Within this framework, 5 specific tasks were identified: (1) quantify the fast photochemical processes controlling OH concentrations, (2) investigate the factors responsible for large-scale low concentrations of tropospheric ozone over the equatorial Pacific, (3) study the role of the ITCZ and SPCZ as barriers to atmospheric transport between the Northern and Southern Hemispheres and within the South Pacific, (4) investigate the scavenging of gases/aerosols associated with deep convection and gas-to-aerosol conversion taking place in convective outflows, and (5) elucidate the processes controlling photochemistry and aerosol formation beneath the trade wind inversion.

The broad design of the PEM-Tropics B campaign employed a series of flights utilizing the NASA Dryden DC-8 and NASA Wallops P-3B aircraft from remote operational sites in the South Pacific Basin. The DC-8's operational sites were Hilo, Hawaii; Nadi, Fiji; Papeete, Tahiti; and Easter Island. The P-3B's operational sites included Christmas Island and Papeete, Tahiti. From these primary bases, flights covered a latitude range of about 20°N to 30°S and 165°E to 95°W in longitude. Table 2a summarizes the DC-8 flights and Table 2b summarizes the P-3B flights. DC-8 flight tracks are shown in Figure 2a while the P3B flight tracks are shown in Figure 2b. Flights 1 through 4 for the DC-8 and flights 1 and 2 for the P-3B, all test flights, are not included in Figure 2a or 2b, respectively. DC-8 flights 6-8, 10-12, 14-18, and 20 were site-intensive flights based out of Hawaii, Fiji, Tahiti, and Easter Island, respectively. DC-8 ferry/transit flights included (a) flight 5 from Dryden to Hawaii; (b) flight 9 from Hawaii to Fiji; (c) flight 13 from Fiji to Tahiti; (d) flight 19 from Tahiti to Easter Island; and flights 21 and 22 from Easter Island to Dryden (via Costa Rica). P-3B flights 6-11 and 13-16 were site intensive flights from Christmas Island and Tahiti, respectively. P-3B ferry/transit flights included (a) flights 3-5 from Wallops to Christmas Island (via Dryden and Hawaii); (b) flight 12 from Christmas Island to Tahiti; and (c) flights 17-19 from Tahiti to Wallops (via Hawaii and Monterey, California). Data archival was optional for flights 2-4 for both the DC-8 and P-3B. Flight plans consisted of combinations of controlled rate of ascent or descent spirals, ramp-up or ramp-down flight legs, and constant altitude flight legs selected to meet the scientific objectives of each flight. In general, 8 to 10 hour missions were flown on the DC-8 covering an altitude range of 300 meters to 10 km. P-3B flight missions ranged from 6 to 10 hours covering an altitude range of about 150 meters to 7 km.

The DC-8 transit flight from Dryden to Hilo investigated northern tropical chemistry. The Hilo, Hawaii based flights focused primarily on photochemistry. Flights 6 and 8 studied sunrise and sunset photochemistry, respectively. Flights 7 and 9 examined equatorial chemistry and equatorial photochemistry, respectively. Fiji flights (10 – 12) investigated the SPCZ, ozone trough, and photochemical aging of air. The Fiji to Tahiti transit flight, 13, was a general equatorial survey. The first Tahiti local flight, flight 14, characterized southern latitudes. Tahiti flights 15 and 16 focused on sunrise and sunset

HO_x/NO_x photochemistry, respectively. The remainder of the DC-8 flights were designed to study transport; ITCZ inflow/outflow (flight 17), frontal crossing characterization (flight 18), tropical convective outflow (flight 19), South American outflow (flight 20), South/Central American outflow (flight 21), and Central American outflow (flight 22).

The P-3B science objectives focused primarily on HO_x photochemistry, sulfur and aerosol chemistry. The Dryden to Hilo transit flight (flight 4) studied the transport of US pollution. During the flight from Hilo to Christmas Island interhemispheric gradients were studied. Many of the Christmas Island flights were designed to assess HO_x and DMS chemistry. Flights 6-8 examined sunset and sunrise HO_x and DMS. Flight 9, from Christmas Island, was an equatorial survey. Flight 10 investigated equatorial upwelling and sunrise DMS and flight 11 focused on equatorial HO_x. The transit flight from Christmas Island to Tahiti (flight 12) studied interhemispheric trace gas gradients. Tahiti local flights 13 and 15 focused on convective clouds, specifically gas/particle conversion. Tahiti local flight 14 examined low-to-mid altitude HO_x. The last Tahiti local flight (16) focused on sunrise sulfur flux and DMS oxidation. The transit flight from Tahiti to Honolulu investigated boundary layer HO_x chemistry. The Honolulu to Monterey, CA and Monterey, CA to Wallops transit flights studied long-range Asian and North American outflow and continental layers, respectively.

The core set of measurements aboard the aircraft focused on evaluating the oxidizing power and aerosol loading of the atmosphere and transport properties of the remote South Pacific. The aircraft data include a suite of chemical measurements which include, but are not limited to, ozone, nitrogen oxide, nitrogen dioxide, nitric acid, nitrous oxide, peroxy acetyl nitrate (PAN), methane, carbon monoxide, carbon dioxide, peroxide, hydroperoxyl radical, sulfur dioxide, sulfuric acid, aerosols, actinic flux, water, halocarbons, alkyl nitrates, dimethyl sulfide (DMS), and dimethyl sulfoxide (DMSO), among others. Table 3 lists the investigators and measurements for the DC-8 and Table 4 lists the same for the P-3B. Archived parameters are given in Table 5. For a complete list of plotted parameters, see Table 6.

The PEM-Tropics B data is not yet available on the Langley DAAC. At a time yet to be determined, the PEM-Tropics B DAAC data archive will include (1) data taken aboard the DC-8 aircraft; (2) data taken aboard the P-3B aircraft; and (3) ozonesonde data. The ozonesonde network was formed and began measurements during the pre-deployment phase of PEM-Tropics B. The ozonesonde data include releases from the following locations prior to mission deployment: Easter Island, Chili; Papeete, Tahiti; Pago Pago, American Samoa; Suva, Fiji; and Lauder, New Zealand. All PEM-Tropics B data is currently available on the GTE archive.

The data plots for the PEM-Tropics B are given in Appendix A. For each DC-8 flight, 13 pages of time series plots are provided: page 1 – a latitude/longitude plot of the flight region and time series plots of altitude, temperature, relative humidity, and water vapor; page 2 – ozone (O_3), carbon monoxide (CO), methane (CH_4), carbon dioxide (CO_2), and hydroxyl radical (OH); page 3 – nitric oxide (NO), nitric acid (HNO_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and dimethyl sulfide (DMS); page 4 – ethyne (C_2H_2), ethene (C_2H_4), propane (C_3H_8), propene (C_3H_6), and ethane (C_2H_6); page 5 – propane/ethane, ethene/ethane, ethyne/carbon monoxide, ethene/carbon monoxide, and ethane/carbon monoxide; page 6 – carbon tetrachloride (CCl_4), perchloroethylene (C_2Cl_4), methyl chloroform (CH_3CCl_3), methyl iodide (CH_3I), and methyl chloride (CH_3Cl); page 7 – chloroform ($CHCl_3$), calcium (Ca^+), ultrafine aerosol ($ULTRA$), unheated fine aerosol ($FINE-UNht$), and fine aerosol ratio ($FINE\ RATIO$); page 8 – peroxide (H_2O_2), methyl hydro peroxide (CH_3OOH) and acetone (CH_3COCH_3), hydroperoxyl radical (HO_2), beryllium-7 (7Be), and formaldehyde (CH_2O); page 9 – nitrate (NO_3^-), chloride (Cl^-), methyl sulfonate (MS), sulfate (SO_4^-), and ammonium (NH_4^+); page 10 – methyl nitrate (CH_3ONO_2), ethyl nitrate ($C_2H_5ONO_2$), isopropyl nitrate ($i-C_3H_7ONO_2$), n-propyl nitrate ($n-C_3H_7ONO_2$), and peroxy acetyl nitrate (PAN); page 11 – HCFC-141B (CH_3CFCl_2), HCFC-142B (CH_3CF_2Cl), HCFC-22 (CHF_2Cl), methylene bromide (CH_2Br_2), and bromoform ($CHBr_3$); page 12 – ozone photolysis frequency ($J(O_3)$), nitrogen dioxide photolysis frequency ($J(NO_2)$), peroxide photolysis frequency ($J(H_2O_2)$), nitrogen dioxide photolysis frequency-zenith viewing ($J(NO_2)z$), and nitrogen dioxide photolysis frequency-nadir viewing ($J(NO_2)n$); page 13 – altitude, cabin altitude, roll angle, sun

elevation, and methylene chloride (CH_2Cl_2). The species were selected to provide the reader with information on both the source characteristics and photochemical history of air. There are no plots prior to flight 5 for the DC-8 or flight 3 for the P-3B, as these were test flights and data archival was not required. Data plots are in standardized format as discussed in Appendix A. The DAAC archive will and GTE archive already does include other measurements aboard the DC-8 and P-3B during PEM-Tropics B which are not plotted in Appendix A.

CONCLUDING REMARKS

This compendium of data from NASA's Global Tropospheric Experiment's Pacific Exploratory Mission to the Tropics, Phase B (PEM-Tropics B) provides only a graphical representation of aircraft data that will be available in archived format from NASA Langley's Distributed Active Archive Center (DAAC) and currently are available from the GTE Project Office archive. The time series plots are not intended to support original research/analysis, but serve as an overview of the PEM-Tropics B aircraft data and provide some assistance to the reader in identifying data that are of interest and which may be obtained from Langley's DAAC archive or GTE's Project Office archive. This compendium covers only selected NASA DC-8 and P-3B aircraft data. The GTE archived data base includes other data measured on board the aircraft as well as numerous supporting data including meteorological observations/products, photochemical modeling products, surface station observations, satellite observations, and ozonesonde and rawin sonde releases. GTE-sponsored analyses/results from the PEM-Tropics B expeditions have been submitted (August 2000) to a Special Issue of the *Journal of Geophysical Research – Atmospheres*.

Questions or information regarding the Langley DAAC archive should be directed to Langley DAAC User and Data Services, Mail Stop 157D, NASA Langley Research Center, Hampton, Virginia, 23681-0001. A brief description of the DAAC, log on procedures, and data bases is given in Appendix B.

Table 1. GTE Field Expeditions Through 1999

Expedition	Date	General Geographic Region	Time of Year
CITE-1	1983	Hawaii	November
CITE-1	1984	Eastern North Pacific – off the California coast	April
ABLE-1	1984	Barbados, French Guyana	June
ABLE-2A	1985	Amazon Basin	August
CITE-2	1986	Western USA	August
ABLE-2B	1987	Amazon Basin	May
ABLE-3A	1988	Alaska – Barrow, Bethel, Cold Bay	July/August
CITE-3	1989	Western North Atlantic – Virginia coast and Western South Atlantic – Brazil coast	August/September
ABLE-3B	1990	Canada – Hudson Bay, Schefferville	July/August
PEM-West A	1991	Western Pacific Rim	October
TRACE-A	1992	Brazil, South Atlantic, Southwest Africa	September
PEM-West B	1994	Western Pacific Rim	February/March
PEM-Tropics A	1996	South Pacific Basin	August/September
PEM-Tropics B	1999	South Pacific Basin	March/April

Table 2(a). Summary of PEM-Tropics B DC-8 Aircraft Flights

Flight No.	Start Date (GMT)	Julian Day (GMT)	Start Time (GMT)	Stop Time (GMT)	Lat. Min (Degs)	Lat. Max (Degs)	Lon. Min (Degs)	Lon. Max (Degs)	Flight Location and Description
1D	02/08/1999	39	10:00:00	12:00:00					NASA DFRC Local Engineering Check Flight
2D#	02/19/1999	50	19:14:30	23:06:22	26.3833	35.7167	-123.95	-117.1	NASA DFRC Local Test Flight # 1
3D#	02/24/1999	55	19:07:29	23:21:42	27.4333	35.2167	-122.55	-117.0833	NASA DFRC Local Test Flight # 2
4D#	03/03/1999	62	18:18:00	0:29:10	27.7667	35.2333	-122.0333	-117.3667	NASA DFRC Local Test Flight # 3
5D*	03/06/1999	65	19:00:55	2:06:33	19.7167	35.1	-155.033	-117.5667	NASA DFRC to Hilo, HI - Northern Tropical Chemistry
6D*	03/09/1999	68	14:09:00	22:40:17	13.7667	19.85	-155.05	-149.0167	Hilo Local # 1 - Sunrise Photochemistry
7D*	03/13/1999	72	19:59:28	5:12:42	-1.3833	19.7833	-165.35	-154.15	Hilo Local # 2 - Equatorial Chemistry
8D*	03/15/1999	74	20:59:11	6:41:16	0	19.7167	-157.4	-152.4833	Hilo Local # 3 - Sunset Photochemistry
9D*	03/17/1999	76	20:27:00	6:33:50	-17.95	19.7167	176.967	-154.883	Hilo, HI to Fiji - Equatorial Photochemistry
10D*	03/20/1999	79	22:25:00	6:11:41	-24.0333	-9.7667	176.783	-174.983	Fiji Local # 1 - SPCZ
11D*	03/22/1999	81	21:17:00	7:37:40	-19	7.1333	148.5333	177.433	Fiji Local # 2 - Ozone Trough
12D*	03/24/1999	83	21:20:22	5:30:45	-17.8833	-1.7	165.9167	177.9667	Fiji Local # 3 - Photochemical Aging of Air
13D*	03/26/1999	85	21:10:56	5:26:36	-22.7	-3.1	177.2	-149.6	Fiji to Tahiti - Equatorial Survey
14D*	03/30/1999	89	20:34:12	4:30:48	-36.3333	-16.6333	-149.6167	-131.2333	Tahiti Local #1 - Southern Latitudes Characterization
15D*	04/02/1999	92	14:26:27	22:13:13	-18.1167	-11.9	-152.2	-147.7833	Tahiti Local # 2 - Sunrise HOx/NOx Chemistry
16D*	04/04/1999	94	22:55:36	7:06:53	-22.1	-17.55	-150.1	-146.5333	Tahiti Local # 3 - Sunset HOx/NOx Chemistry

Table 2(a). Concluded

Flight No.	Start Date (GMT)	Julian Day (GMT)	Start Time (GMT)	Stop Time (GMT)	Lat. Min (Degs)	Lat. Max (Degs)	Lon. Min (Degs)	Lon. Max (Degs)	Flight Location and Description
18D*	04/10/1999	100	20:10:03	4:05:18	-33.1167	-13.9667	-155.3667	-148.4833	Tahiti Local # 5 - Frontal Crossing Characterization
19D*	04/13/1999	103	22:39:33	6:53:32	-27.15	-4.9833	-149.583	-109.433	Tahiti to Easter - Tropical Convective Outflow
20D*	04/15/1999	105	14:28:23	23:47:24	-27.1833	-5	-119.55	-108.9833	Easter Local # 1 - South American Outflow
21D*	04/17/1999	107	14:03:05	22:41:45	-27.2667	10	-109.5167	-84.1833	Easter to Costa Rica - South/Central American Outflow
22D*	04/18/1999	108	17:06:38	23:22:12	9.9333	34.9833	-117.8833	-84.1167	Costa Rica to Dryden - Central American Outflow

* Data archival is required

Data archival is optional

Table 2(b). Summary of PEM-Tropics B P-3B Aircraft Flights

Flight No.	Start Date (GMT)	Julian Day (GMT)	Start Time (GMT)	Stop Time (GMT)	Lat. Min (Degs)	Lat. Max (Degs)	Lon. Min (Degs)	Lon. Max (Degs)	Flight Location and Description
1P	03/04/1999	63	20:38:05	1:29:45	36.1084	37.94	-75.4974	-72.6053	NASA WFF Test Flight # 1
2P#	03/07/1999	66	17:57:34	23:41:58	37.0659	37.9881	-75.5101	-75.6333	NASA WFF Test Flight # 2
3P#	03/10/1999	69	19:35:30	3:09:35	34.7976	38.0023	-117.8659	-75.4394	NASA WFF to NASA DFCR Test Flight # 3
4P#	03/11/1999	70	19:33:44	3:00:54	19.7225	35.0099	-155.0753	-117.8218	NASA DFCR to Hilo, HI Transport of US Pollution
5P*	03/13/1999	72	18:59:24	3:14:23	-0.0854	19.7223	-157.6726	-154.9066	Hilo, HI to Christmas Island Interhemispheric Gradients
6P*	03/15/1999	74	20:39:51	5:08:08	0.9191	2.325	-157.763	-154.5006	Christmas Island Local # 1 Sunset BL, HOx and DMS Flux
7P*	03/17/1999	76	14:33:05	20:09:11	-1.0906	1.992	-157.4252	-156.6062	Christmas Island Local # 2 Sunrise to Sunset HOx & DMS
8P*	03/17/1999	76	22:34:30	4:27:25	-1.4238	2.0158	-157.4005	-156.5	Christmas Island Local # 3 Sunrise to Sunset HOx & DMS
9P*	03/20/1999	79	16:59:50	1:14:35	-0.0237	2.0256	-157.3806	-139.9772	Christmas Island Local # 4 Equatorial Survey
10P*	03/22/1999	81	14:44:56	0:53:10	-0.6021	1.9928	-157.4448	-152.8383	Christmas Island Local # 5 Equatorial Upwelling & Sunrise DMS
11P*	03/24/1999	83	21:38:27	5:34:35	-1.2889	1.9866	-157.3983	-155.8228	Christmas Island Local # 6 Equatorial HOx
12P*	03/26/1999	85	18:51:37	3:02:45	-17.7163	1.9348	-165.9883	-149.6086	Christmas Island to Tahiti Interhemispheric Trace Gas Grad.
13P*	03/31/1999	90	18:36:15	3:50:55	-17.7302	-5.6551	-149.7854	-142.5973	Tahiti Local # 1 Convective Cloud; Gas/Particle Conversion
14P*	04/04/1999	94	20:54:58	5:17:20	-21.9976	-17.5368	-150.0424	-149.6076	Tahiti Local # 2 Low/Mid-Altitude HOx
15P*	04/05/1999	95	20:00:42	4:02:49	-17.5514	-7.5083	-149.6045	-140.2392	Tahiti Local # 3 Convective Cloud; Gas/Particle Conversion
16P*	04/07/1999	97	14:56:35	1:26:42	-17.6296	-12.3281	-149.7111	-141.7371	Tahiti Local # 4 Sunrise Sulfur Flux & DMS Oxidation

Table 2(b). Concluded

Flight No.	Start Date (GMT)	Julian Day (GMT)	Start Time (GMT)	Stop Time (GMT)	Lat. Min (Degs)	Lat. Max (Degs)	Lon. Min (Degs)	Lon. Max (Degs)	Flight Location and Description
17P*	04/09/1999	99	19:00:37	2:18:28	-17.5546	21.3165	-157.9982	-149.5921	Tahiti to Honolulu, HI BL HOx Chemistry
18P*	04/10/1999	100	19:02:40	1:52:13	21.1883	36.6385	-157.9307	-121.854	Honolulu, HI to Monterey, CA Long Range Asian & NA Outflow
19P*	04/11/1999	101	16:49:58	23:31:40	36.561	39.9023	-121.8413	-75.3355	Monterey, CA to NASA WFF Continental Layers

*Data archival is required

Data archival is optional

Table 3. DC-8 Investigators/Measurements

Principal Investigator	Organization	Parameters
Bruce Anderson	Langley Research Center	CCN
Elliot Atlas	National Center for Atmospheric Research	Alkyl nitrates, halocarbons
Don Blake	University of California-Irvine	NMHC, halocarbons, alkyl nitrates
Ed Browell	Langley Research Center	Nadir & zenith aerosol and ozone profiles
Ed Browell	Langley Research Center	Nadir & zenith aerosol and water vapor profiles
Bill Brune	Pennsylvania State University	OH, HO ₂
Gerry Gregory	Langley Research Center	O ₃
Brian Heikes	University of Rhode Island	H ₂ O ₂ , CH ₃ OOH, CH ₂ O
M. J. Mahoney	Jet Propulsion Laboratory	Temperature profiles
Glen Sachse	Langley Research Center	CO, CO ₂ , CH ₄ , N ₂ O, H ₂ O
Scott Sandholm	Georgia Institute of Technology	NO, NO ₂
Rick Shetter	National Center for Atmospheric Research	Nadir & zenith actinic flux
Hanwant Singh	Ames Research Center	PAN, PPN, CH ₃ ONO ₂ , C ₂ Cl ₄ , tracer species
Bob Talbot	University of New Hampshire	HNO ₃ , SO ₂ , aerosols
GTE Project	Langley Research Center/ Dryden Flight Research Center	Latitude, Longitude, Wind speed & direction, Pressure & radar altitude, Cabin altitude, Static & total air temperature, IR surface temperature, Pitch & roll angle, Sun elevation & azimuth, Dew point, Relative humidity, NO ₂ photolysis rate, Specific humidity, Forward & nadir cloud video, Storm Scope

Table 4. P-3B Investigators/Measurements

Principal Investigator	Organization	Parameters
Bruce Anderson	Langley Research Center	TAMMS, winds, Lyman-alpha
Elliot Atlas	National Center for Atmospheric Research	Alkyl nitrates, halocarbons
Alan Bandy	Drexel University	SO ₂ , DMS
Don Blake	University of California-Irvine	NMHC, halocarbons, alkyl nitrates
Antony Clarke	University of Hawaii	Aerosols
Fred Eisele	Georgia Institute of Technology	OH, H ₂ SO ₄ , MSA, NH ₃ , DMSO
Gerry Gregory	Langley Research Center	O ₃
Brian Heikes	University of Rhode Island	H ₂ O ₂ , CH ₃ OOH, CH ₂ O
Brian Ridley	National Center for Atmospheric research	O ₃ , NO, NO ₂
Glen Sachse	Langley Research Center	CO, CO ₂ , CH ₄
Rick Shetter	National Center for Atmospheric Research	Nadir & zenith actinic flux
Bob Talbot	University of New Hampshire	HNO ₃ , Aerosols
GTE Project	Langley Research Center	Latitude, Longitude, Wind speed & direction, Pressure & radar altitude, Differential pressure, Static pressure, Cabin altitude, Static & total air temperature, Potential temperature, IR surface temperature, Pitch & roll angle, Dew point, Relative humidity, NO ₂ photolysis rate, Specific humidity, Storm Scope, Forward & nadir cloud video

Table 5. Archived PEM-Tropics B Parameters

PI	Platform	Number of Parameters	Description
Anderson	DC-8	6	CN aerosol number density (>8 to <1000nm & >18 to <1000nm)(volatile[250C] and non-volatile); CN aerosol size distribution (0.1-3µm & 0.3-20µm)
Anderson-TAMMS	P-3B	17	Static pressure, Pitch & roll angle, True & platform heading, N/S & E/W velocity, Vertical velocity, Latitude, Longitude, Static & virtual potential temperature(theta V), Specific humidity, Variance Theta V & vertical velocity, Variance Lyman Alpha & vertical acceleration
Atlas	P-3B & DC-8	30	Methyl nitrate(CH ₃ ONO ₂), Ethyl nitrate(C ₂ H ₅ ONO ₂), Isopropyl nitrate(i-C ₃ H ₇ ONO ₂), N-propyl nitrate(n-C ₃ H ₇ ONO ₂), 2-butyl nitrate(2-C ₄ H ₉ ONO ₂), Methylene chloride(CH ₂ Cl ₂), HCFC-141B(CH ₃ CFCl ₂), HCFC-142B(CH ₃ CF ₂ Cl), HFC-134A (CH ₂ FCF ₃), Chloroform(CHCl ₃), Methylene bromide(CH ₂ Br ₂), Dibromochloromethane (CHBr ₂ Cl), Bromoform(CHBr ₃), Perchloroethylene (C ₂ Cl ₄), HCFC-22 (CHF ₂ Cl)
Bandy	P-3B	2	Sulfur dioxide(SO ₂), Dimethyl sulfide(DMS)(CH ₃ SCH ₃)
Blake	P-3B & DC-8	116	Methyl Chloride(CH ₃ Cl), F-12(CCl ₂ F ₂), F-114(CClF ₂ CClF ₂), F-11(CCl ₃ F), HCFC-142B (CH ₃ CF ₂ Cl), HCFC-141B (CH ₃ CFCl ₂), HCFC 134a(CH ₂ FCF ₃), HCFC 22(CHF ₂ Cl), Bromochloromethane(CH ₂ BrCl), Methyl chloroform(CH ₃ CCl ₃), Carbon tetrachloride(CCl ₄), Dibromochloromethane (CHBr ₂ Cl), Methylene bromide(CH ₂ Br ₂), Methylene chloride (CH ₂ Cl ₂), Bromodichloromethane(CHBrCl ₂), Perchloroethylene(C ₂ Cl ₄), Bromoform(CHBr ₃), H-1211 (CBrClF ₂), F-113(CCl ₂ FCClF ₂), H-2402(C ₂ Br ₂ F ₄), Methyl Iodide(CH ₃ I), Dimethylsulfide (DMS)(CH ₃ SCH ₃), Methyl nitrate(CH ₃ ONO ₂), Ethyl nitrate(C ₂ H ₅ ONO ₂), i-propyl nitrate(i-C ₃ H ₇ ONO ₂), n-propyl nitrate(n-C ₃ H ₇ ONO ₂), 2-butyl nitrate(2-C ₄ H ₉ ONO ₂), Ethane(C ₂ H ₆), Propene(C ₃ H ₆), i-butane(i-C ₄ H ₁₀), n-butane(n-C ₄ H ₁₀), t-2butene (t-CH ₃ CHCHCH ₃), 1-butene (CH ₂ CHCH ₂ CH ₃), i-butene (i-C ₄ H ₈), c-2-butene (c-CH ₃ CHCHCH ₃), Ethyne(C ₂ H ₂), i-pentane(i-C ₅ H ₁₂), n-pentane(n-C ₅ H ₁₂), Chloroform (CHCl ₃), Methyl bromide(CH ₃ Br),

Table 5. Continued

PI	Platform	Number of Parameters	Description
Blake (cont.)	P-3B & DC-8	116	Ethylendichloride (1 2-C ₂ H ₄ Cl ₂), Ethylene(C ₂ H ₄), Cyclopropane (CH ₂ CH ₂ CH ₂), Propadiene (CH ₂ CCH ₂), Propane (C ₃ H ₈), isoprene (CH ₂ CHCCH ₃ CH ₂), n-hexane (CH ₃ C ₄ H ₉ CH ₃), cyclohexane (C ₆ H ₁₂), benzene (C ₆ H ₆), ethyl benzene (C ₂ H ₅ C ₆ H ₅), n-heptane (CH ₃ C ₅ H ₁₀ CH ₃), toluene (C ₆ H ₅ CH ₃), n-octane (CH ₃ C ₆ H ₁₂ CH ₃), p-xylene (C ₈ H ₁₀), p-xylene (C ₈ H ₁₀), o-xylene (C ₈ H ₄ C ₂ H ₆), 2 2 4-trimethylpentane (C ₃ H ₉ CCH ₂ CHC ₂ H ₆), 2 3 4-trimethylpentane (C ₈ H ₁₈)
Browell-DIAL	DC-8	4	Nadir & zenith aerosol and ozone profiles
Browell-LASE	DC-8	5	Nadir & zenith aerosol and water vapor profiles, Tropopause height
Brune	DC-8	3	Hydroxyl radical(OH), Hydroperoxyl radical(HO ₂), HO ₂ /OH
Clarke	P-3B	30	Heated and unheated fine number density(Dp<13nm), ratio fine heated to unheated, Ultrafine number density(Dp>3nm, 3nm<Dp<10nm), Scattering coefficient @ 450, 550, 700nm (Dp<100nm & Total), Particle absorption coefficient @ 565nm, Size Distribution(number, area and volume dist.)(40, 150, 300C)(10nm<Dp<250nm), Size distribution(number, area, volume dist)(40, 150, 300C)(100nm<Dp<5000nm), LWC
Eisele	P-3B	5	Hydroxyl radical(OH), Sulfuric acid(H ₂ SO ₄), Methane sulfonic acid (MSA) (CH ₃ SO ₃ H), Ammonia(NH ₃), Dimethyl sulfoxide(DMSO)(CH ₃ SOCH ₃)
Gregory	P-3B & DC-8	2	Ozone(O ₃)(10 Hz on DC-8; 1hz on P-3B)
Heikes	P-3B & DC-8	6	Peroxide(H ₂ O ₂), Methyl hydroperoxide(CH ₃ OOH), Formaldehyde(CH ₂ O)
Mahoney	DC-8	16	# retrieval levels, Pressure altitude, GPS altitude, Latitude, Longitude, Pitch, Roll, Air temperature, Tropopause #1 altitude, Tropopause #2 altitude, Lapse rate, CM dimension, Combo matrix CM, Std. Error on T, Geometric altitude, Number density
Ridley	P-3B	3	Ozone(O ₃), Nitric oxide(NO), Nitrogen dioxide(NO ₂)

Table 5. Continued

PI	Platform	Number of Parameters	Description
Sachse	P-3B	2	Carbon monoxide(CO), Carbon dioxide(CO ₂)
Sachse	DC-8	6	Carbon monoxide(CO), Carbon dioxide(CO ₂), Methane(CH ₄), Nitrous oxide (N ₂ O), Water(H ₂ O)(1 Hz & 20 Hz)
Sandholm	DC-8	2	Nitric Oxide(NO), Nitrogen dioxide(NO ₂)
Shetter	P-3B & DC-8	22+	Nadir & zenith actinic flux $f(\lambda)$; Photolysis frequencies for: Ozone(O ₃), Nitrogen dioxide(NO ₂), Formaldehyde(CH ₂ O), Nitrous acid(HONO), Nitric acid(HNO ₃), PAN(CH ₃ C(O)OONO ₂), Peroxide(H ₂ O ₂), Methylhydroperoxide (CH ₃ OOH), Methyl nitrate(CH ₃ ONO ₂), Ethyl nitrate(CH ₃ CH ₂ ONO ₂), Acetone (CH ₃ COCH ₃)
Singh	DC-8	9	Peroxy acetyl nitrate(PAN)(CH ₃ C(O)OONO ₂), Peroxy propionyl nitrate(PPN) (C ₂ H ₅ C(O)OONO ₂), Methyl nitrate(CH ₃ ONO ₂), Tetrochloroethylene(C ₂ Cl ₄), Acetone(CH ₃ COCH ₃), Methanol(CH ₃ OH), Ethanol(C ₂ H ₅ OH), Ethyl/i-propyl nitrate(C ₂ H ₅ ONO ₂ /i-C ₃ H ₇ ONO ₂), Acetaldehyde(CH ₃ CHO)
Talbot	DC-8	13	Gas Phase: Nitric Acid(HNO ₃), Sulfur dioxide(SO ₂); Aerosols: Nitrate(NO ₃), Sulfate(Non-sea-salt)(SO ₄ ²⁻), Chloride(Cl ⁻), Methyl Sulfonate(MS)(CH ₃ SO ₃ ⁻), Sodium(Na ⁺), Potassium(K ⁺), Ammonium(NH ₄ ⁺), Magnesium(Mg ²⁺), Calcium(Ca ²⁺), Lead 210(²¹⁰ Pb), Beryllium 7(⁷ Be)
Talbot	P-3B	5	Gas Phase: Nitric Acid(HNO ₃); Aerosols: Nitrate(NO ₃), Sulfate(Non-sea-salt)(SO ₄ ²⁻), Methyl Sulfonate(MS)(CH ₃ SO ₃ ⁻), Ammonium(NH ₄ ⁺)
Project	P-3B	28	Julian day, Time, Latitude, Longitude, Wind speed & direction, Pressure & radar altitude, Differential pressure, Static pressure, Cabin altitude, Static & total air temperature, Potential temperature, IR surface temperature, True air speed, Ground speed, Mach number, Pitch & roll angle, True heading, Track angle, Dew point, Dew point validity, Relative humidity, Saturation vapor pressure, NO ₂ photolysis rate, Specific humidity

Table 5. Concluded

PI	Platform	Number of Parameters	Description
Project	DC-8	36	<p>Julian day, Time, Latitude, Longitude, Wind speed & direction, Pressure & radar altitude, Cabin altitude, Static & total air temperature, IR surface temperature, Partial pressure of water vapor, True & indicated air speed, Ground speed, Vertical air speed, Mach number, Pitch & roll angle, True heading, Drift angle, Time & distance to go, Alignment status, Cross track distance, Desired track angle, Track angle error, Track angle, Sun elevation & azimuth, Dew point, Relative humidity, Saturation vapor pressure, NO₂ photolysis rate, Specific humidity</p>

Table 6. Plotted Parameter Chemical Names and Formulas

Formula	Name
Alt	altitude
^7Be	beryllium-7
Ca^+	calcium
CCl_4	carbon tetrachloride
CHBr_3	bromoform
CHCl_3	chloroform
CHF_2Cl	HCFC-22
CH_2Br_2	methylene bromide
CH_2Cl_2	methylene chloride
CH_2O	formaldehyde
CH_3CCl_3	methyl chloroform
CH_3CFCl_2	HCFC-141B
$\text{CH}_3\text{CF}_2\text{Cl}$	HCFC-142B
CH_3COCH_3	acetone
$\text{CH}_3\text{C(O)OONO}_2$	peroxy acetyl nitrate (PAN)
CH_3Cl	methyl chloride
CH_3I	methyl iodide
CH_3ONO_2	methyl nitrate
CH_3OOH	methyl hydro peroxide
CH_3SCH_3	dimethyl sulfide (DMS)
CH_3SO_3^-	methyl sulfonate (MS)
CH_3SOCH_3	dimethyl sulfoxide (DMSO)
$\text{CH}_3\text{SO}_3\text{H}$	methane sulfonic acid(MSA)
CH_4	methane
Cl^-	chloride
CO	carbon monoxide
CO_2	carbon dioxide
C_2Cl_4	perchloroethylene
C_2H_2	ethyne
C_2H_4	ethene
$\text{C}_2\text{H}_5\text{ONO}_2$	ethyl nitrate
C_2H_6	ethane
C_3H_6	propene
$i\text{-C}_3\text{H}_7\text{ONO}_2$	isopropyl nitrate
$n\text{-C}_3\text{H}_7\text{ONO}_2$	n-propyl nitrate
C_3H_8	propane
HNO_3	nitric acid
HO_2	hydroperoxyl radical
H_2O_2	peroxide
H_2SO_4	sulfuric acid
Ht	heated
$\text{J(H}_2\text{O}_2)$	peroxide photolysis frequency

Table 6. Concluded

Formula	Name
$J(\text{NO}_2)$	nitrogen dioxide photolysis frequency
$J(\text{NO}_2)_z$	nitrogen dioxide photolysis frequency-zenith viewing
$J(\text{NO}_2)_n$	nitrogen dioxide photolysis frequency-nadir viewing
$J(\text{O}_3)$	ozone photolysis frequency
LWC	liquid water content, g/m ³
NH_3	ammonia
NH_4^+	ammonium
NO	nitric oxide
NO_2	nitrogen dioxide
NO_3^-	nitrate
OH	hydroxyl radical
O_3	ozone
Pot Temp	potential temperature
Rel Hum	relative humidity
SO_2	sulfur dioxide
SO_4^-	sulfate
Uht	unheated

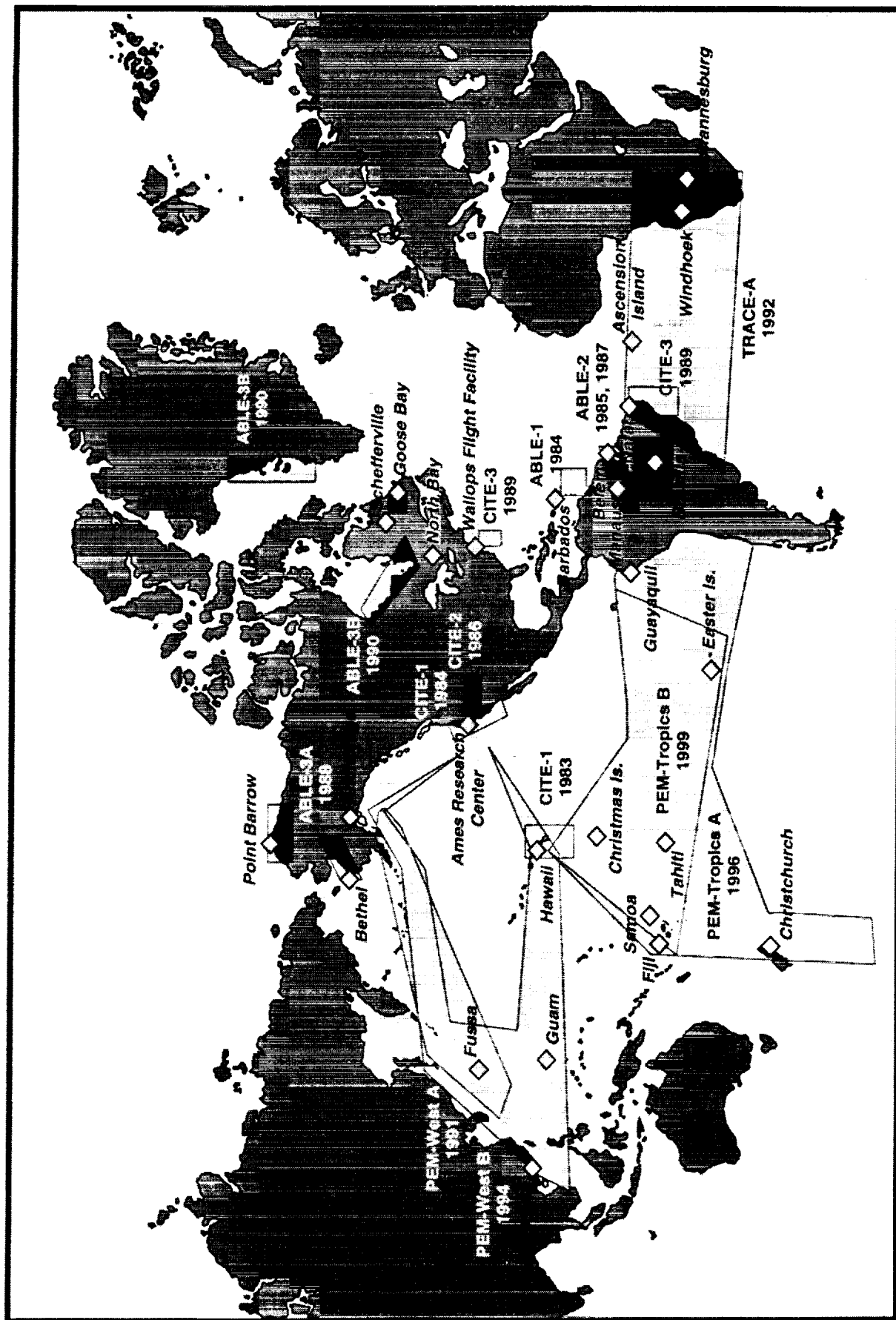


Figure 1. GTE missions through 1999.

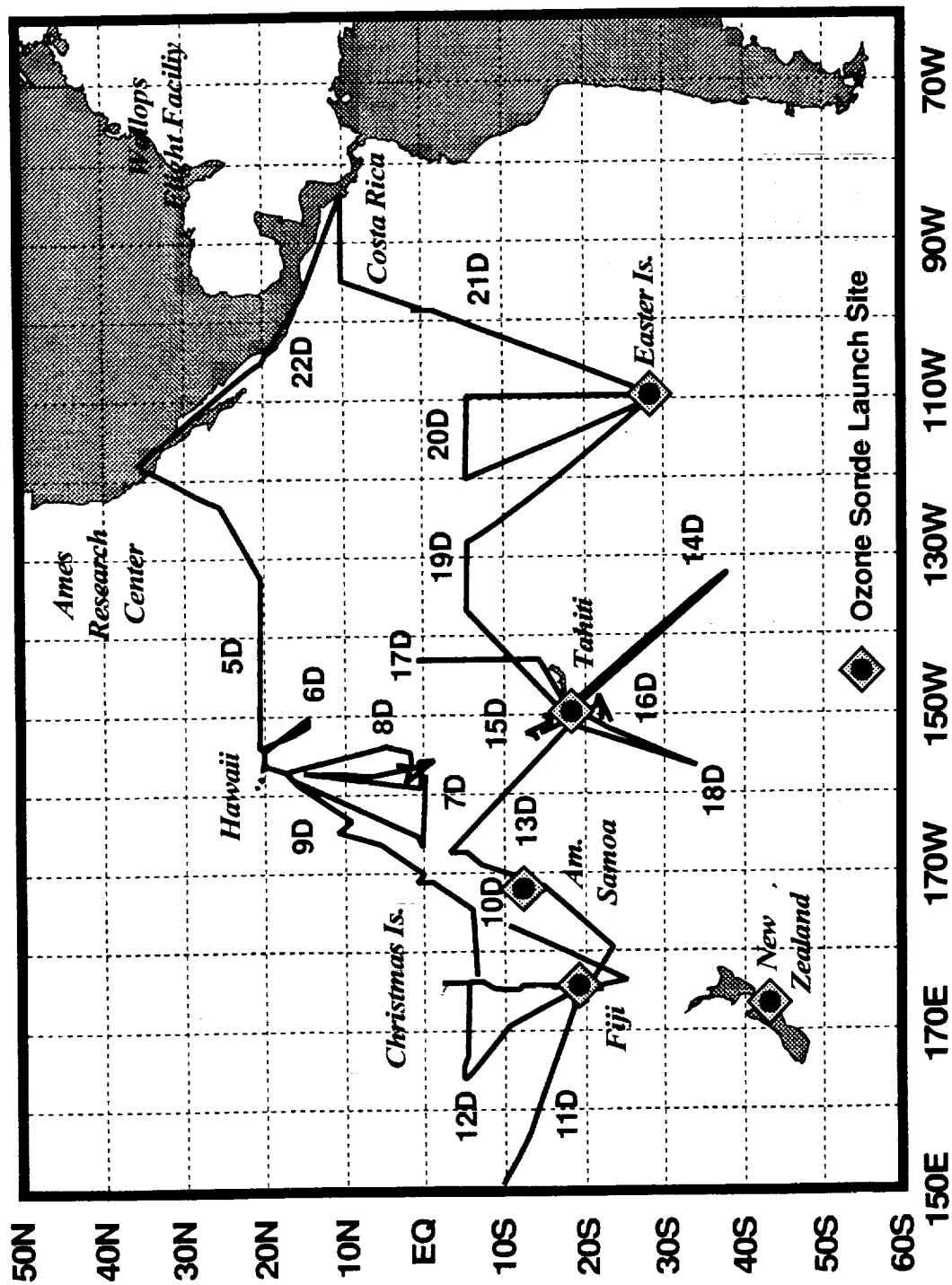


Figure 2(a). PEM-Tropics B DC-8 flight tracks.

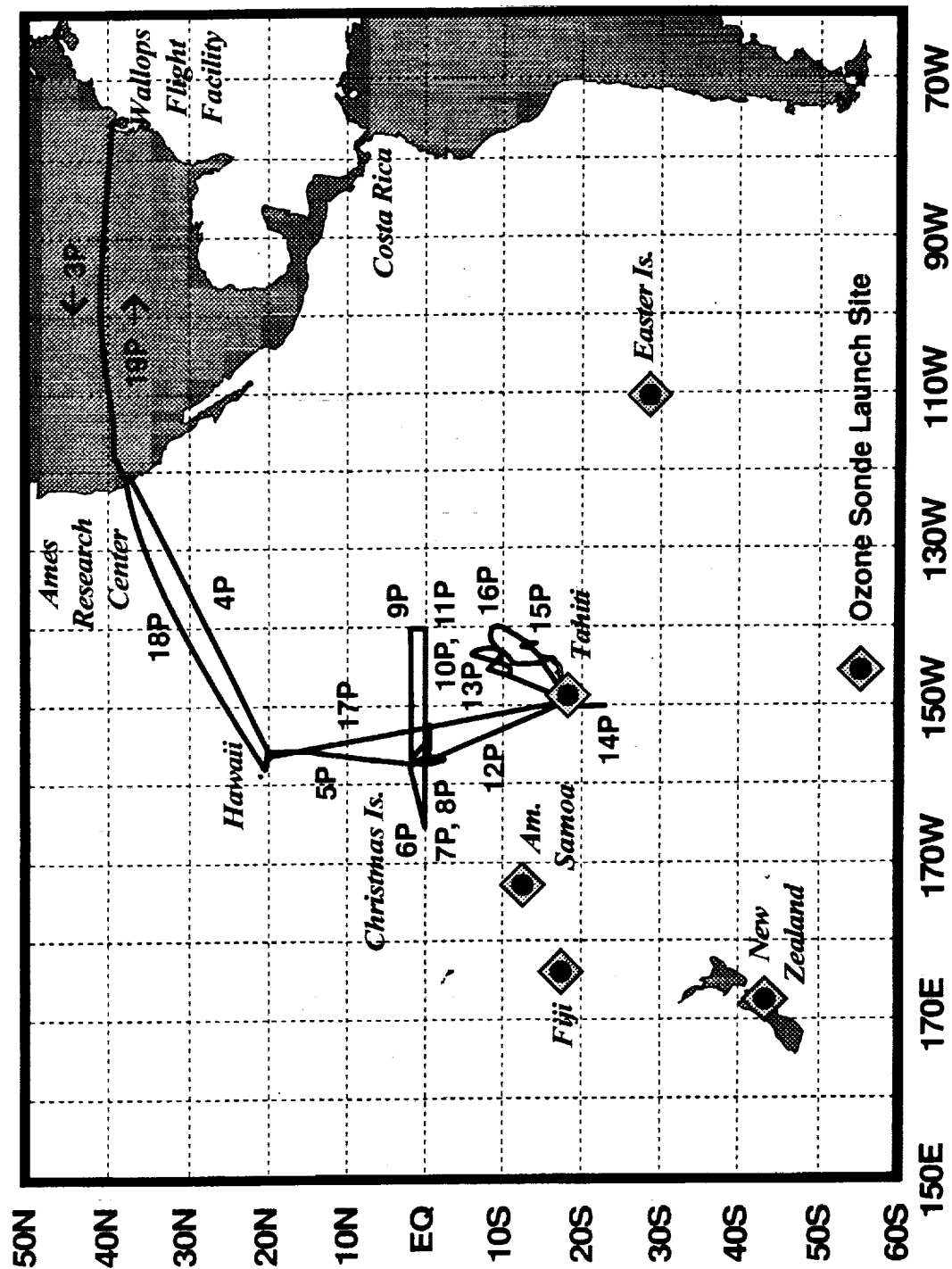


Figure 2(b). PEM-Tropics B P-3B flight tracks.

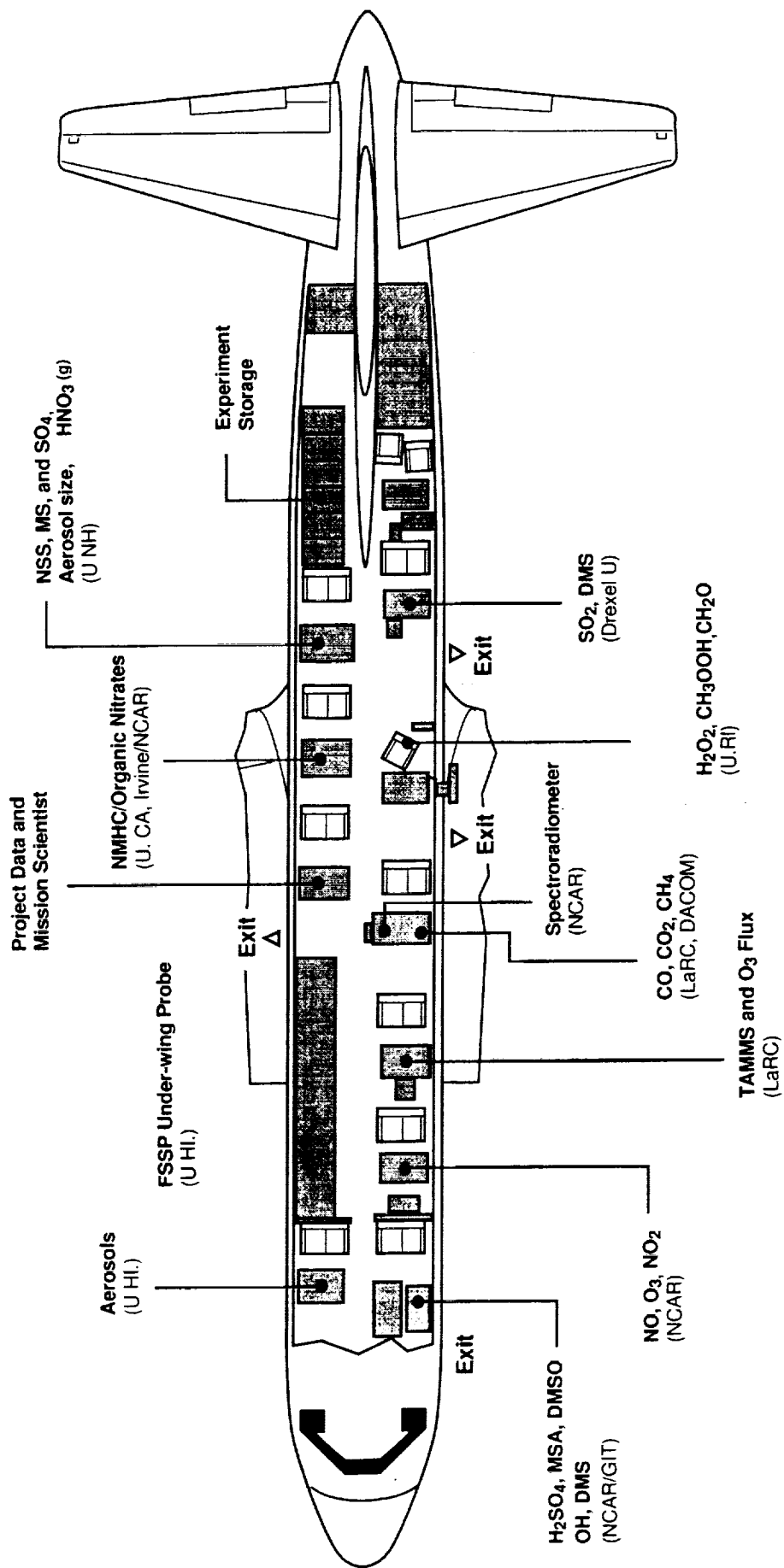


Figure 3(b). PEM-Tropics B P-3B mission payload floor plan.

APPENDIX A
PACIFIC EXPLORATORY MISSION TO THE TROPICS, PHASE B
(PEM-TROPICS B)

Plots are presented in a standardized format, and the data (unedited) are from the Langley GTE archive. Relative humidity is calculated from measurements made on the aircraft. In some cases (mostly for moist, boundary layer conditions) relative humidity may exceed 100% (not plotted) as dew point temperature exceeded air temperature by a few degrees (assumed to be the result of instrument measurement/calibration uncertainty). For time series plots, abscissa time scales for a given flight are identical. Ordinate scales were selected to best represent all the data for a specie measured during the flight. In order to maintain the standardized format, plots for flights in which a specie data were not reported are plotted with the axes and a "NO DATA" entry.

Given below are the beginning page numbers for each flight's sequence of plots:

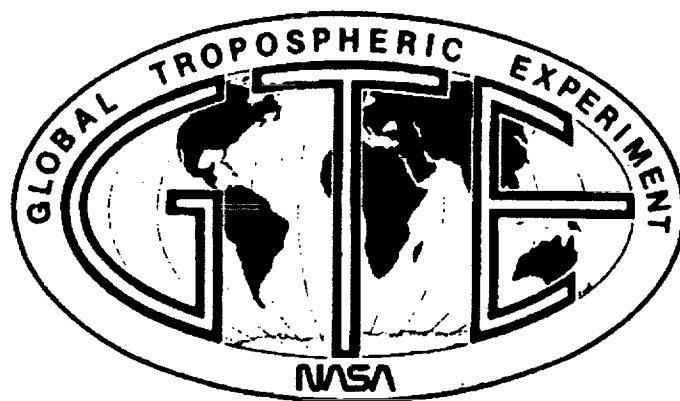
Flight 5D – page 32
Flight 6D – page 46
Flight 7D – page 60
Flight 8D – page 74
Flight 9D – page 88
Flight 10D – page 102
Flight 11D – page 116
Flight 12D – page 130
Flight 13D – page 144
Flight 14D – page 158
Flight 15D – page 172
Flight 16D – page 186
Flight 17D – page 200
Flight 18D – page 214
Flight 19D – page 228
Flight 20D – page 242

Flight 21D – page 256

Flight 22D – page 270

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PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

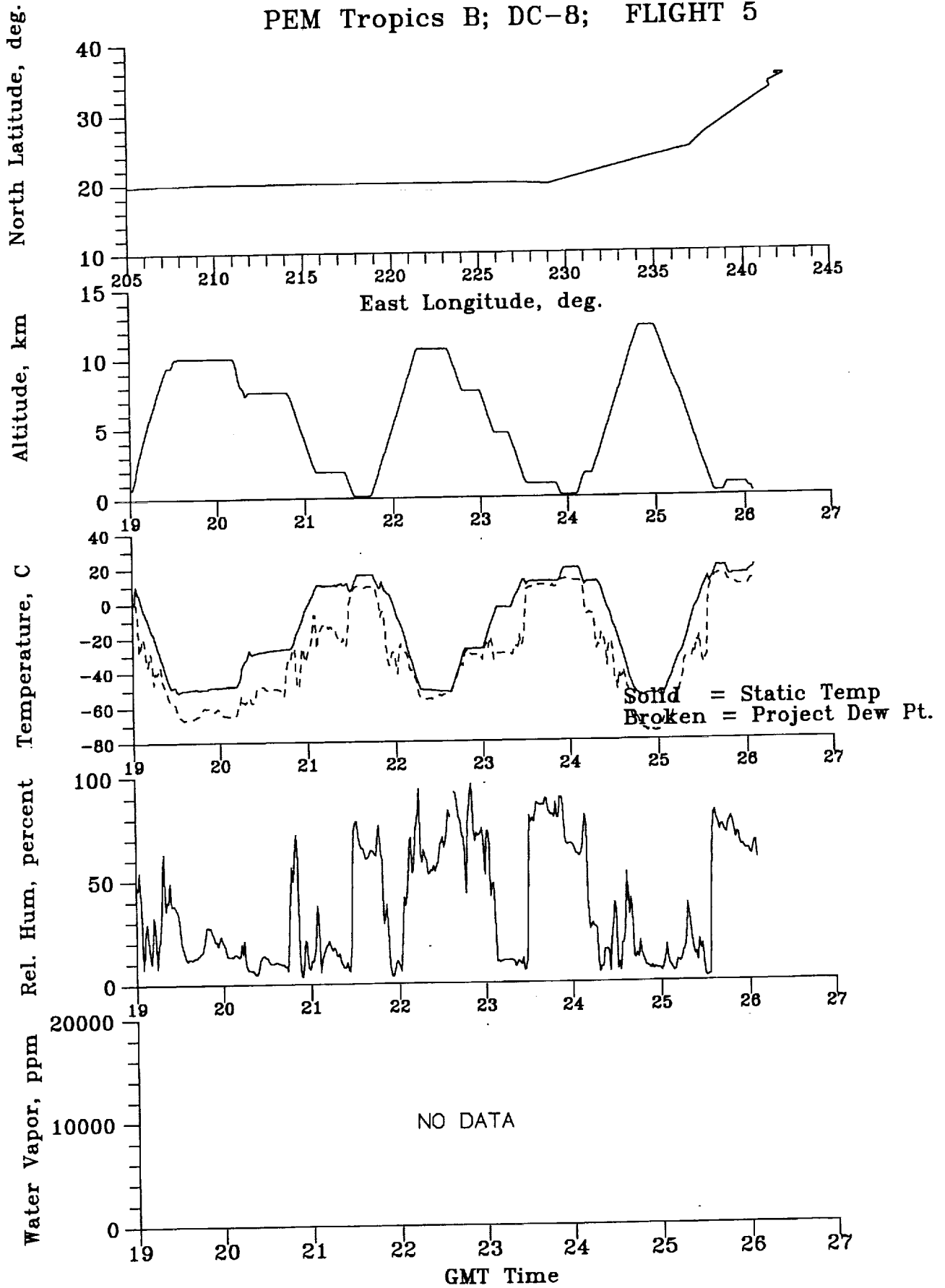
Flight 5D

Transit: NASA DFRC to Hilo, HI

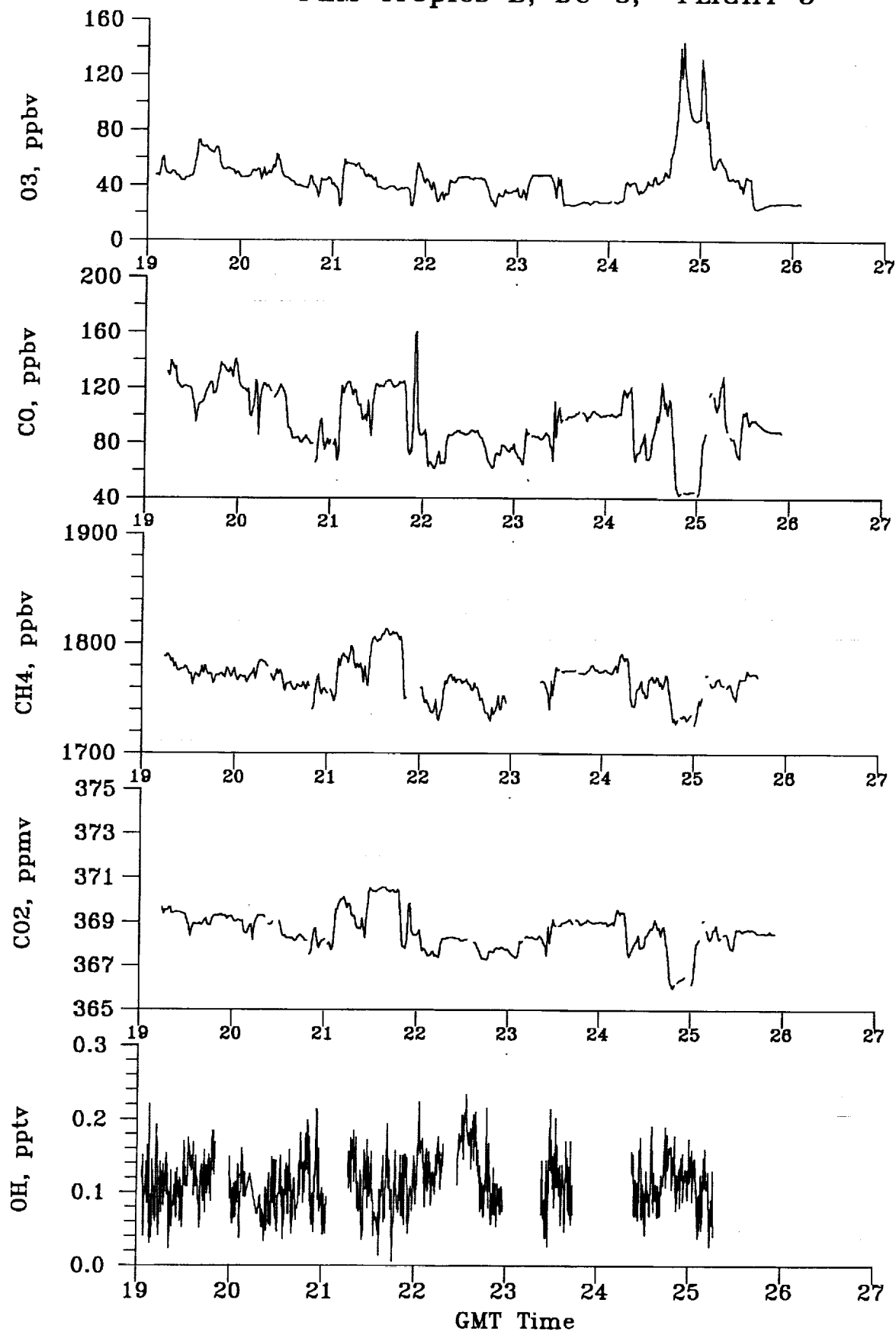
Northern Tropical Chemistry

March 6, 1999

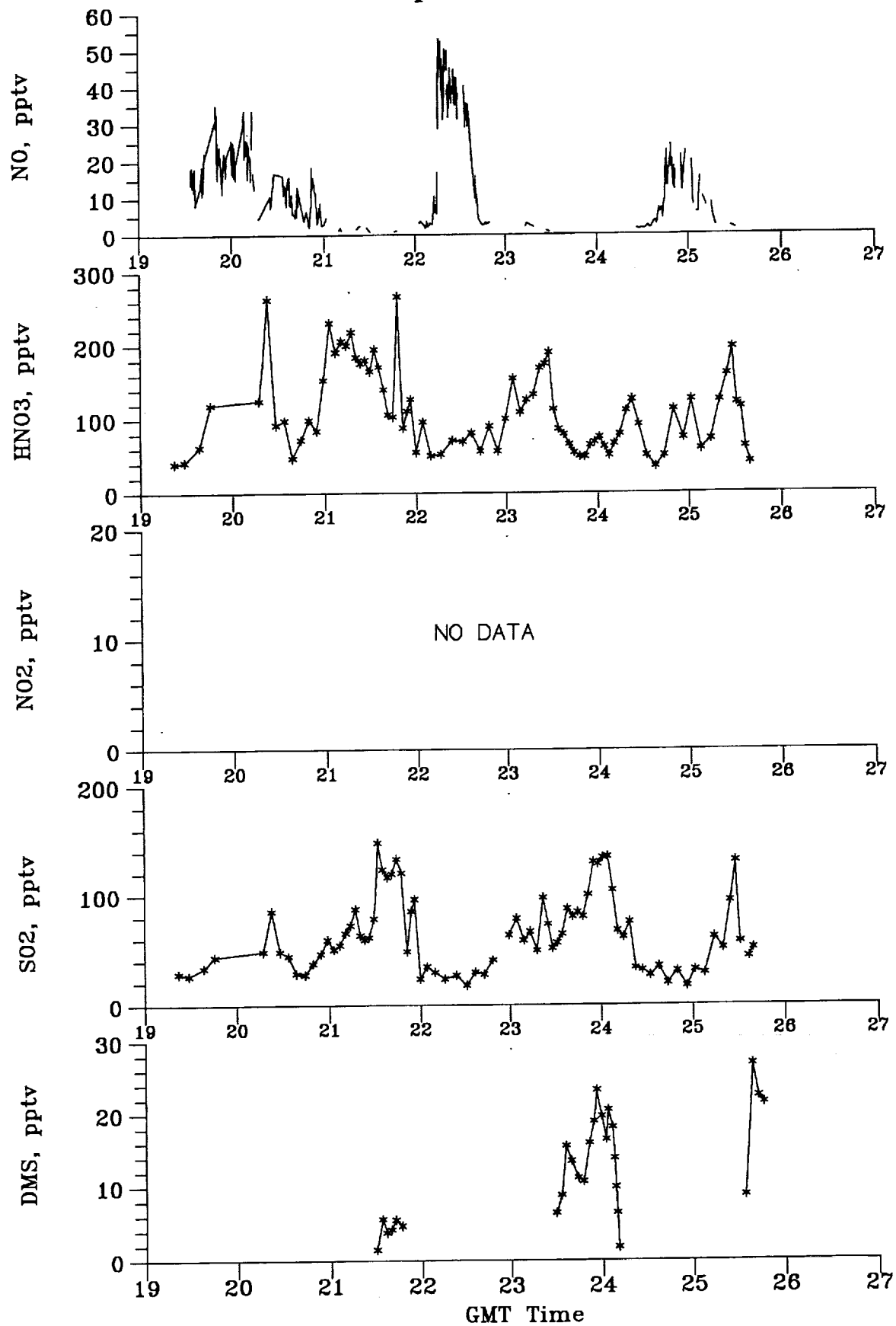
PEM Tropics B; DC-8; FLIGHT 5



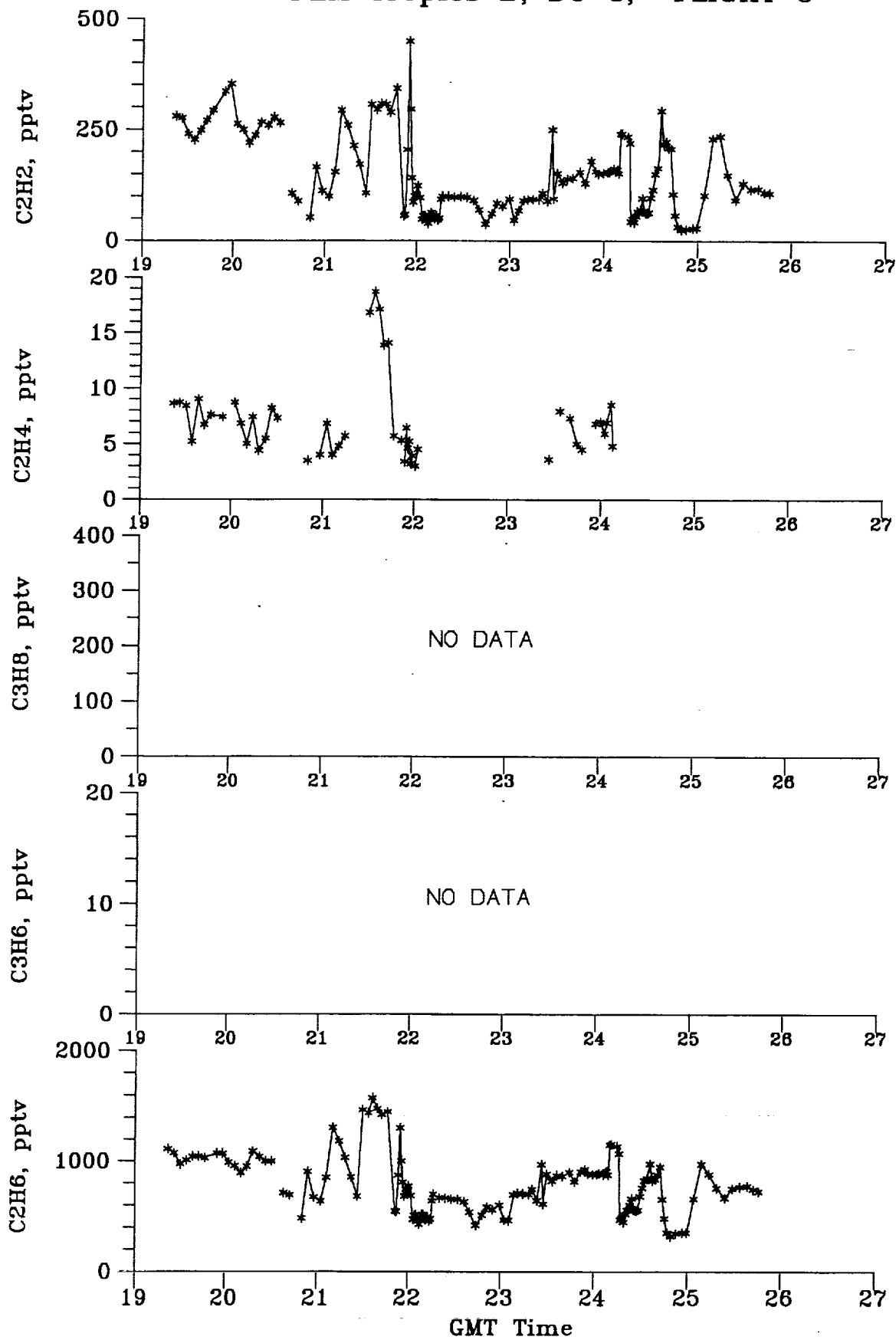
PEM Tropics B; DC-8; FLIGHT 5



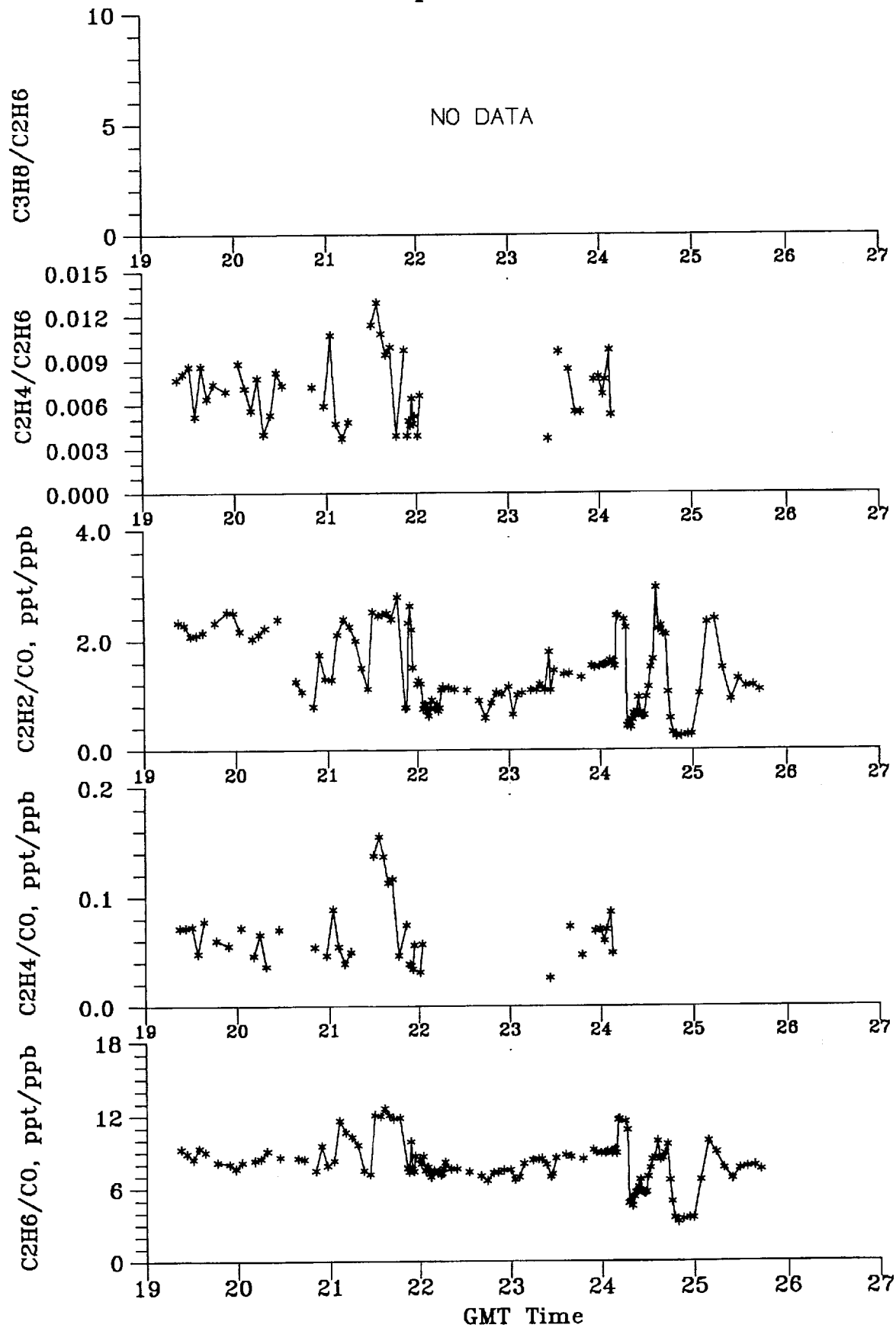
PEM Tropics B; DC-8; FLIGHT 5



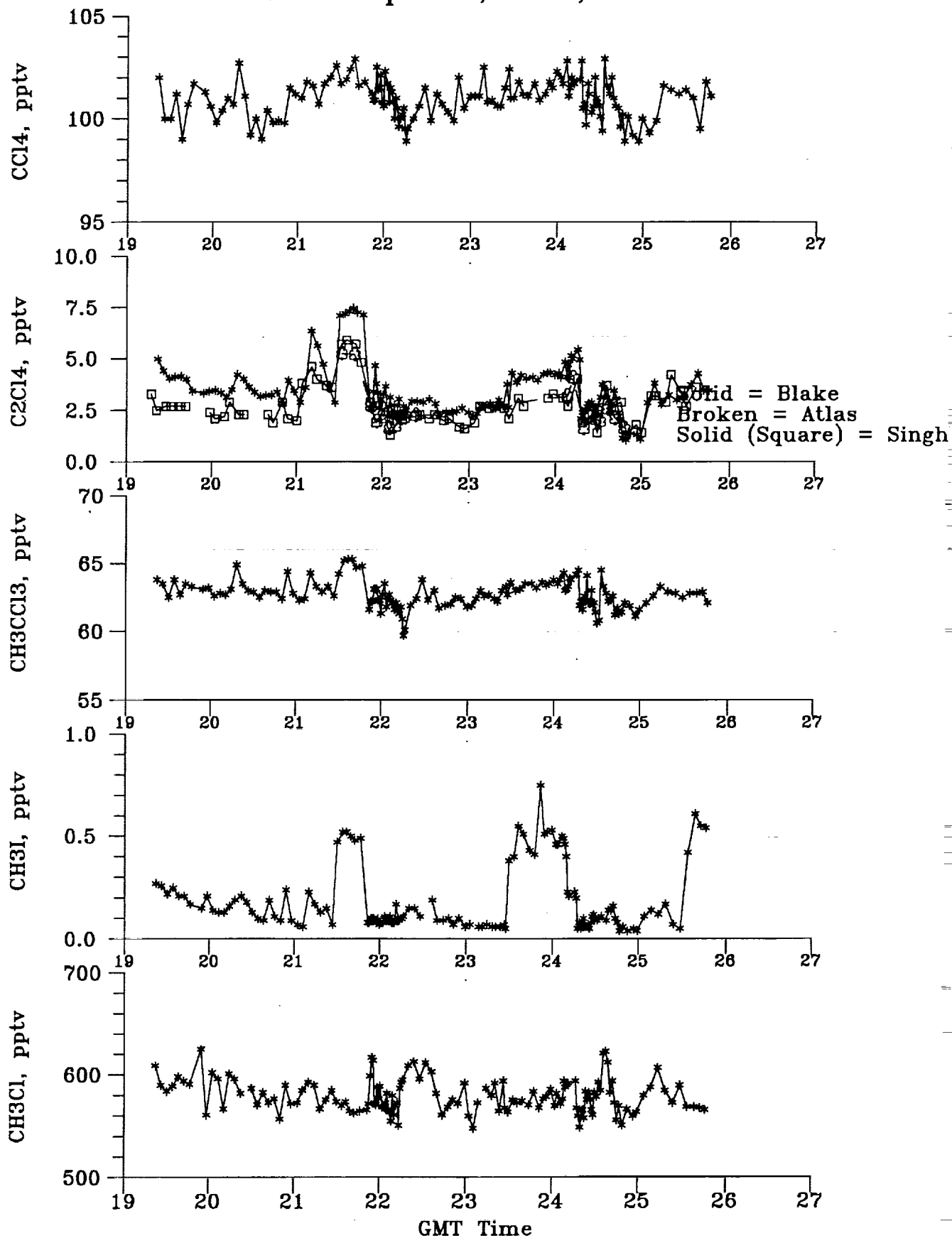
PEM Tropics B; DC-8; FLIGHT 5



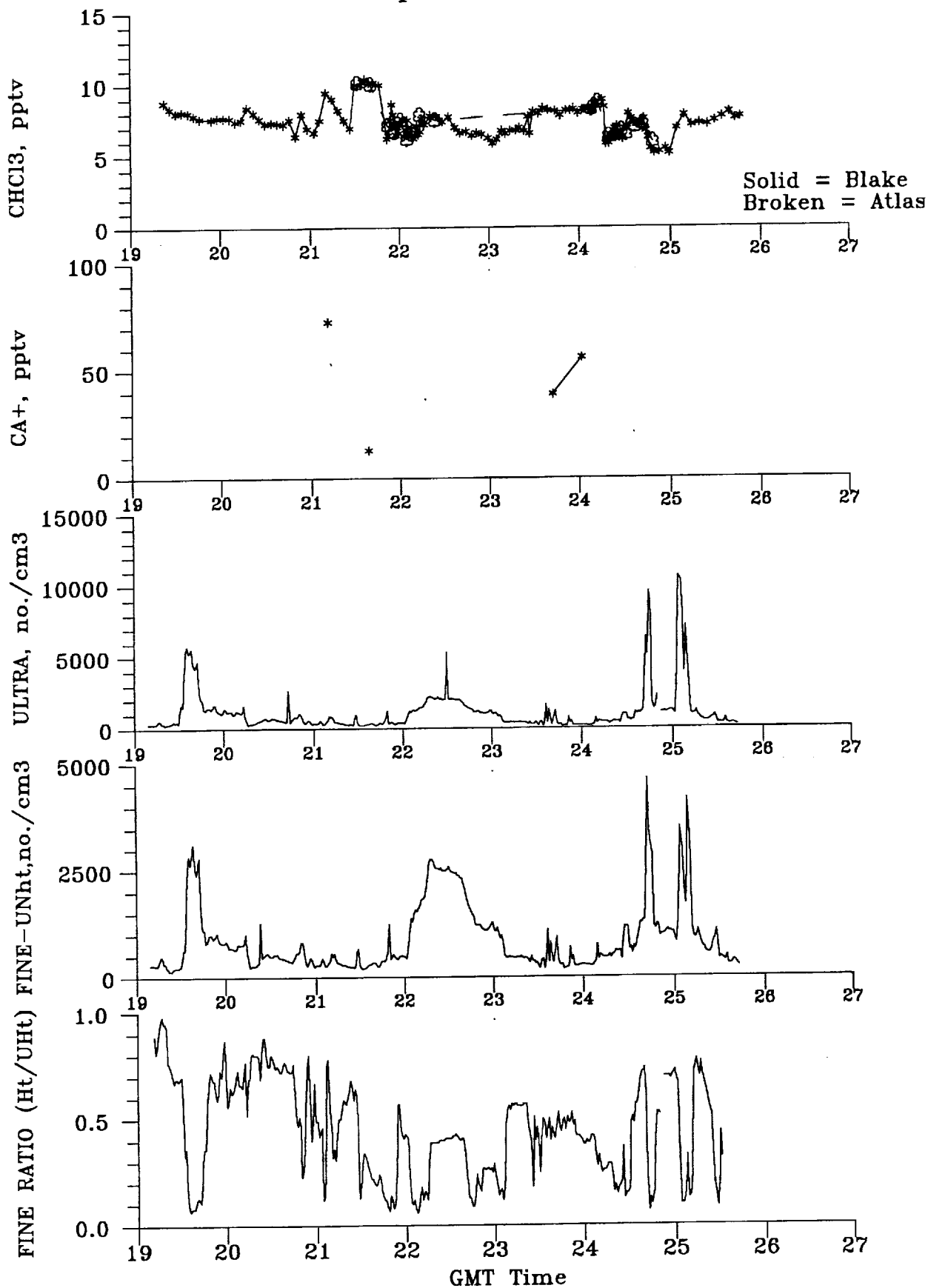
PEM Tropics B; DC-8; FLIGHT 5



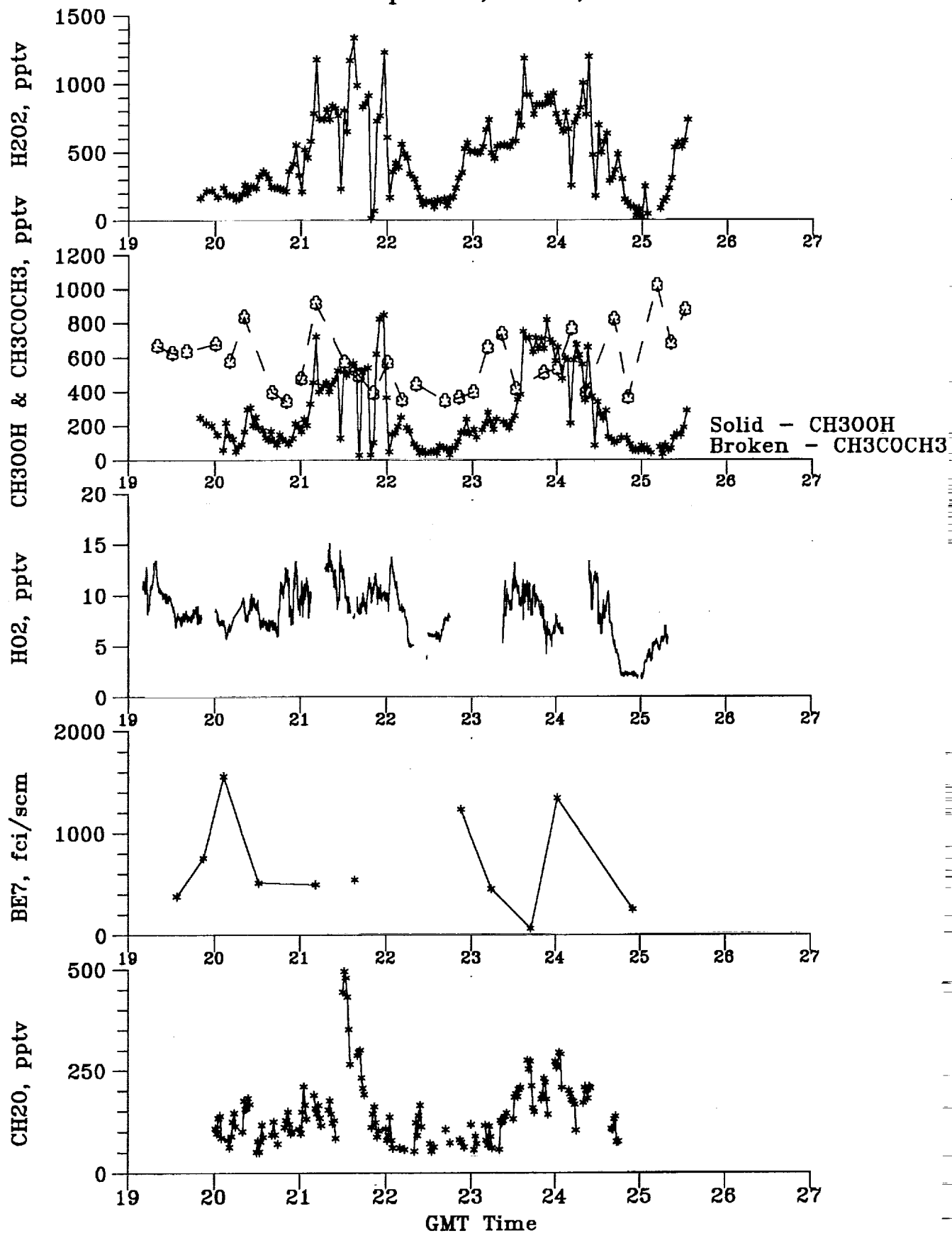
PEM Tropics B; DC-8; FLIGHT 5



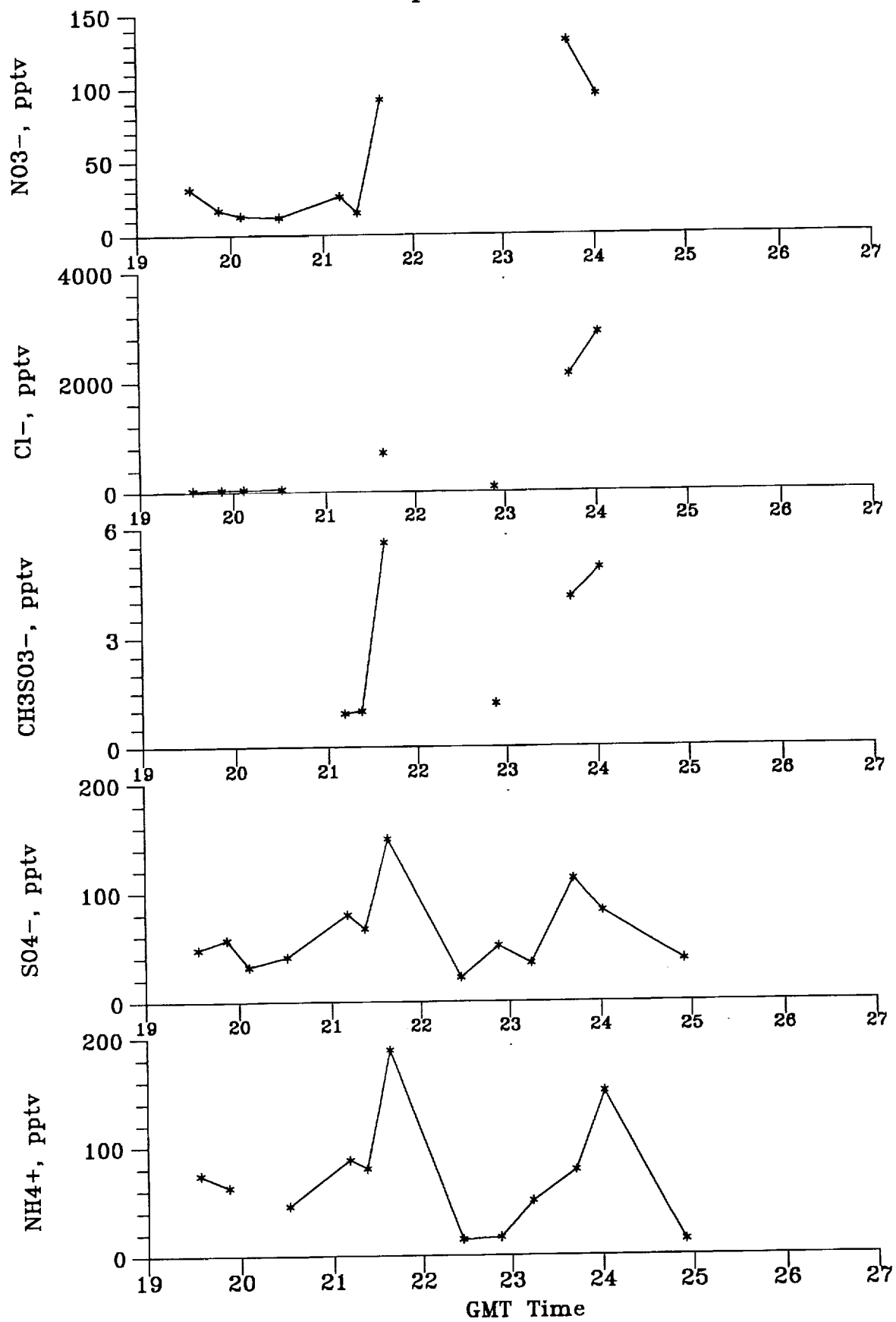
PEM Tropics B; DC-8; FLIGHT 5



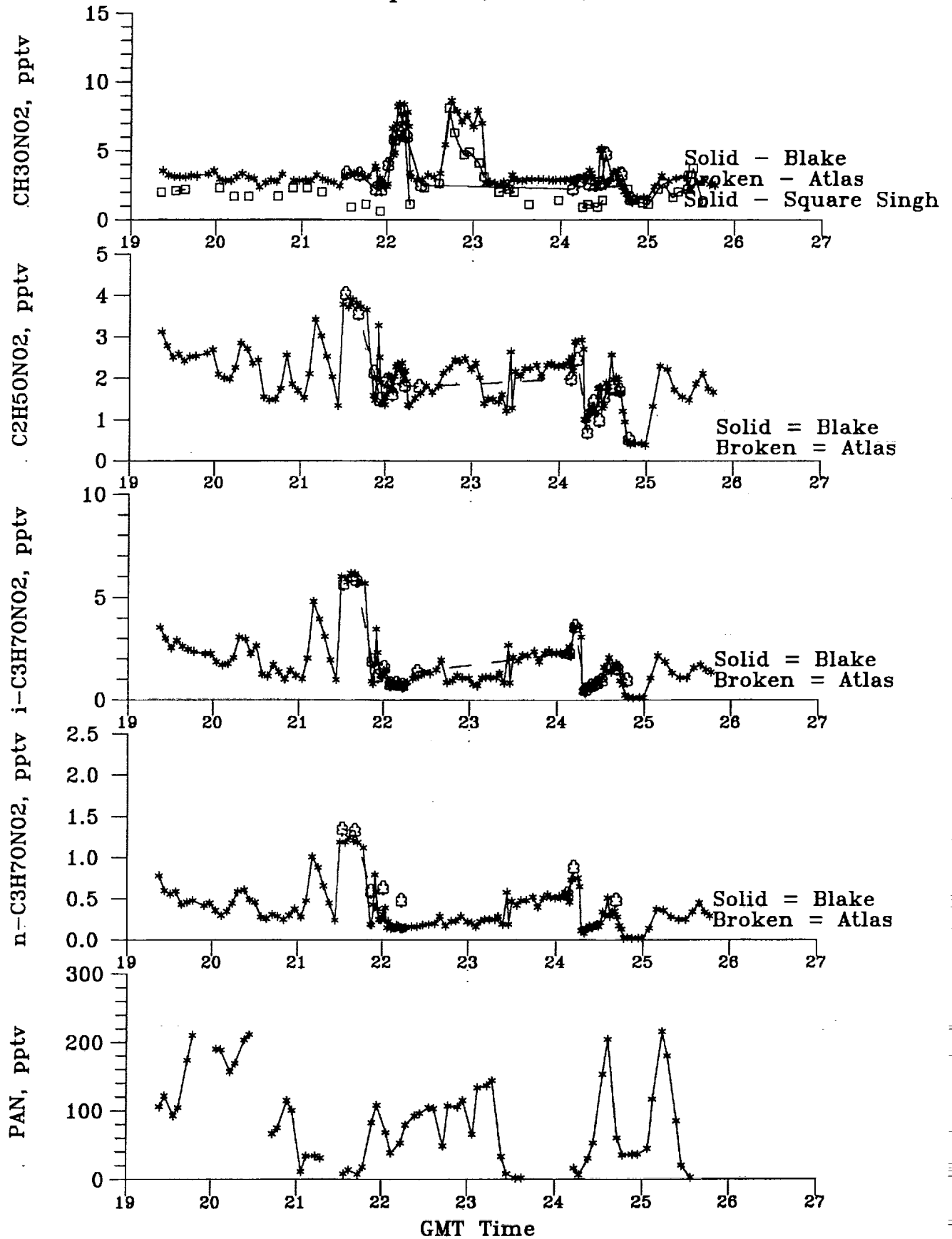
PEM Tropics B; DC-8; FLIGHT 5



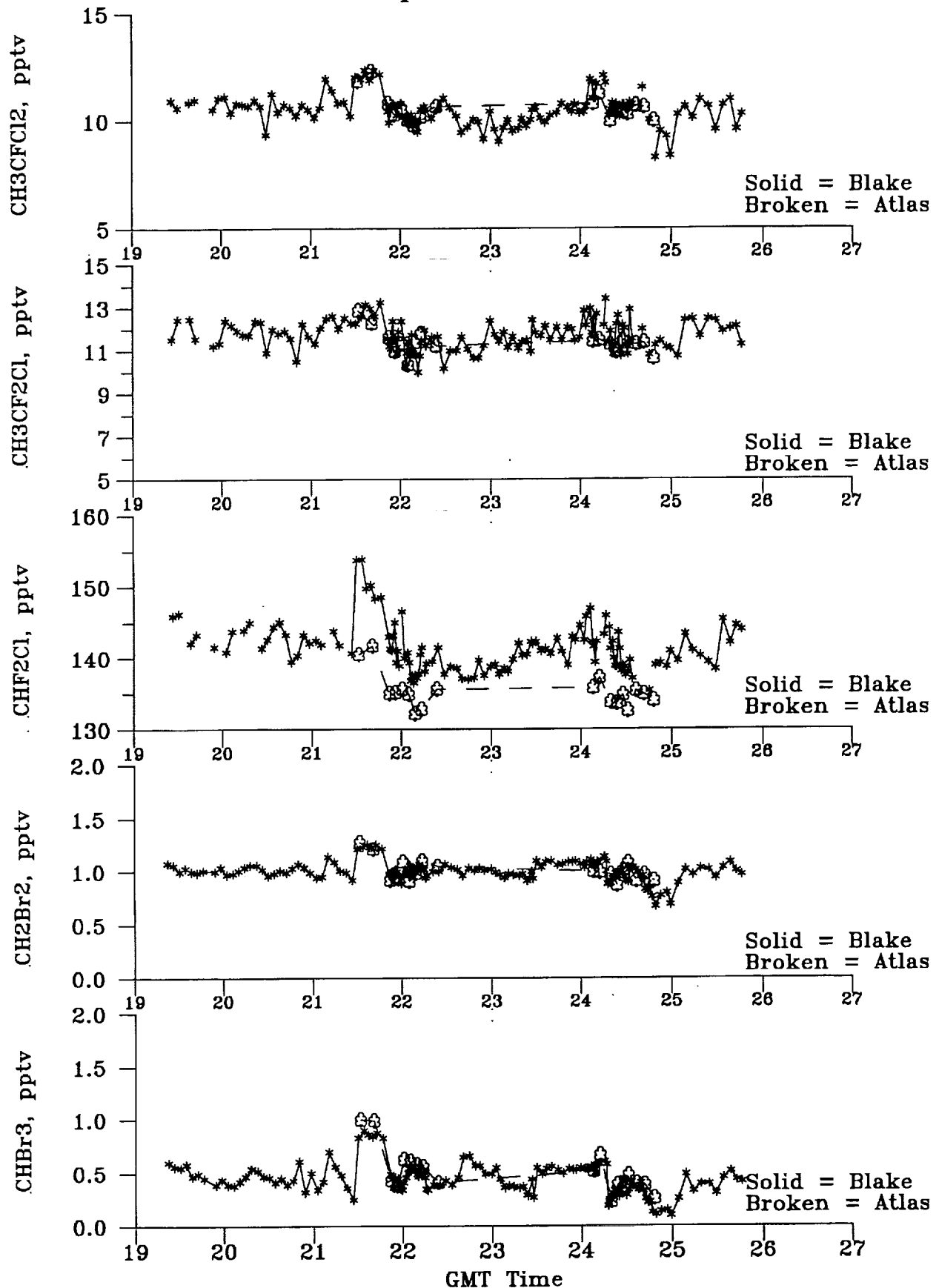
PEM Tropics B; DC-8; FLIGHT 5



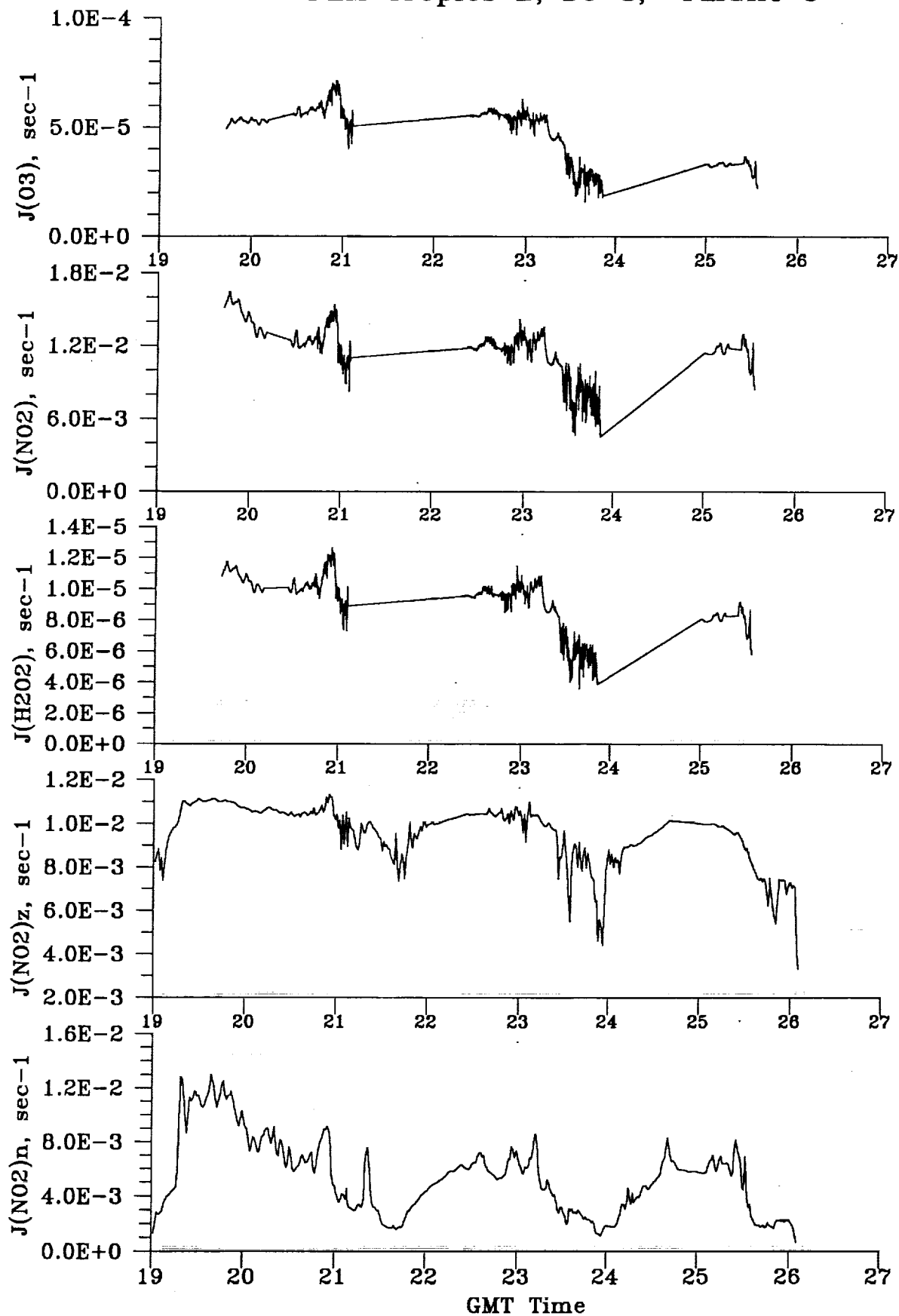
PEM Tropics B; DC-8; FLIGHT 5



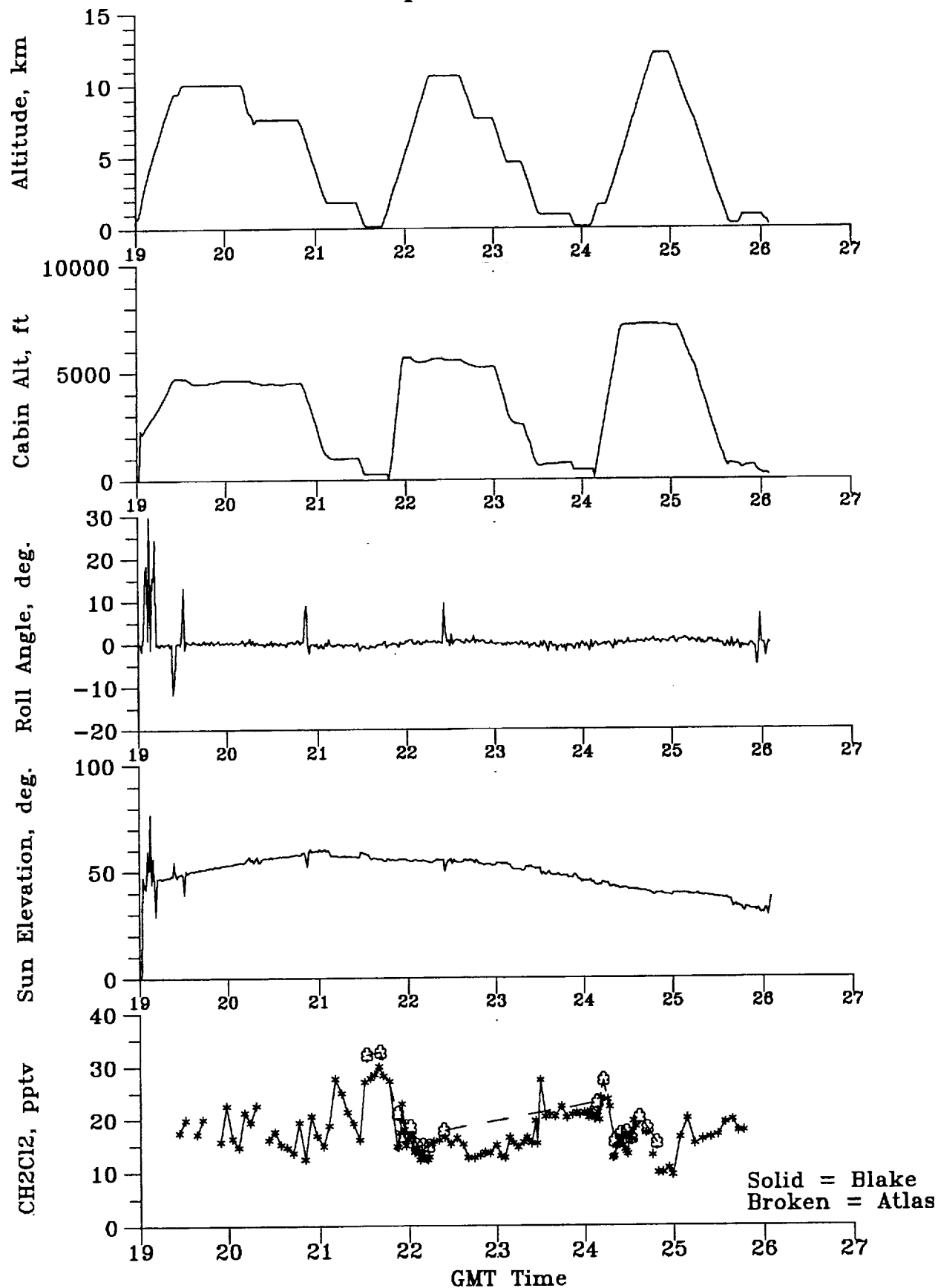
PEM Tropics B; DC-8; FLIGHT 5



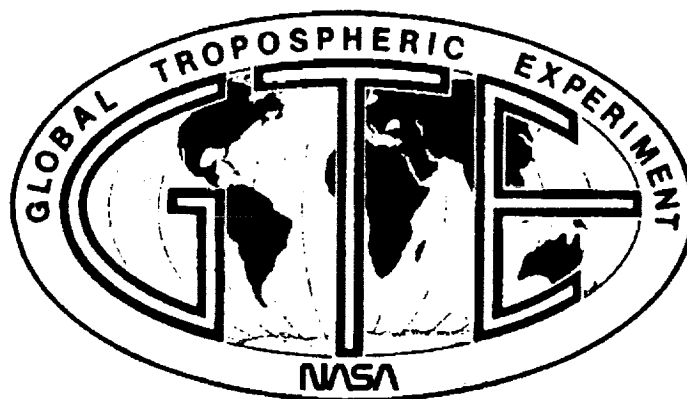
PEM Tropics B; DC-8; FLIGHT 5



PEM Tropics B; DC-8; FLIGHT 5



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

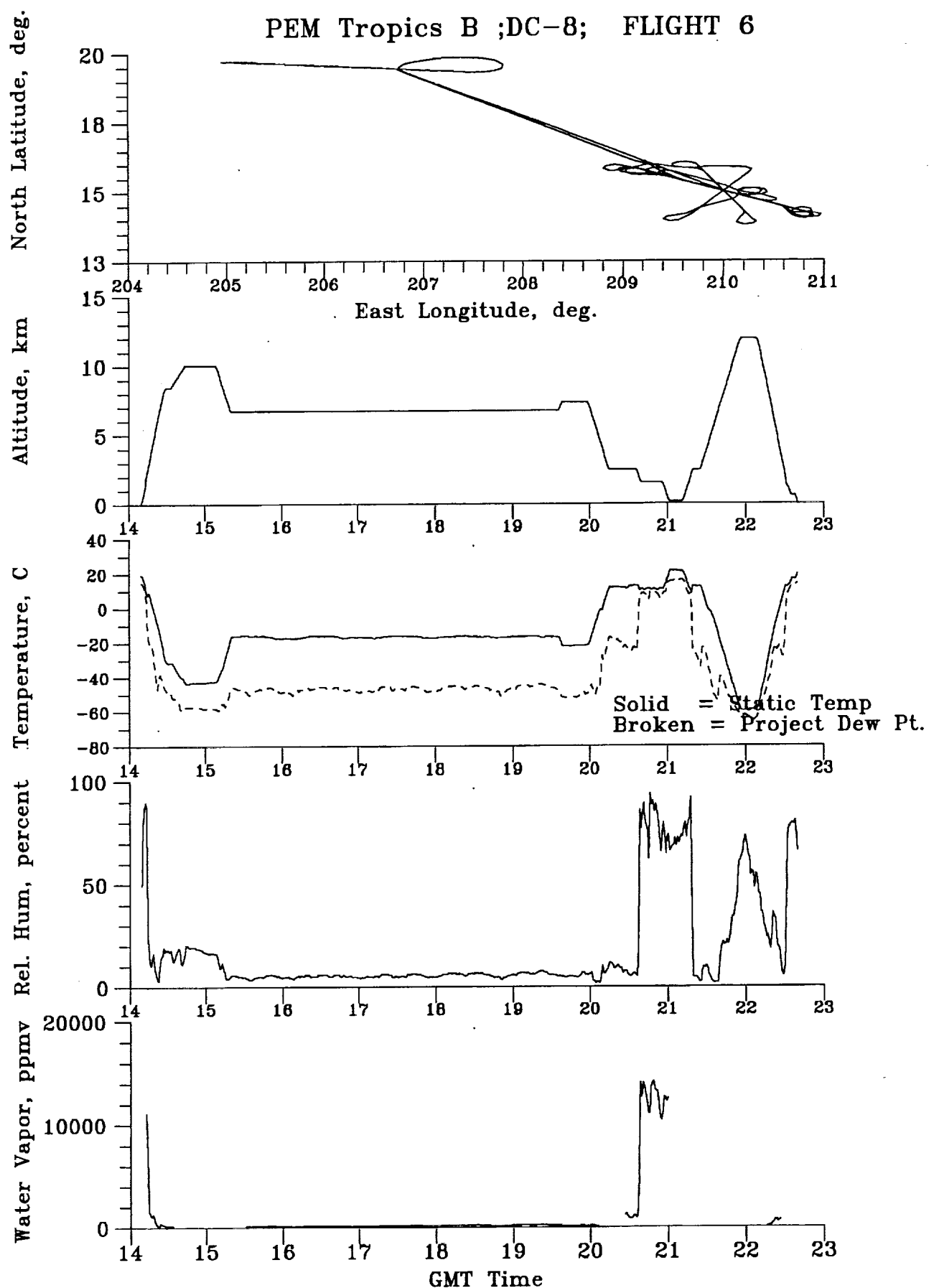
Flight 6D

Local: Hilo No. 1

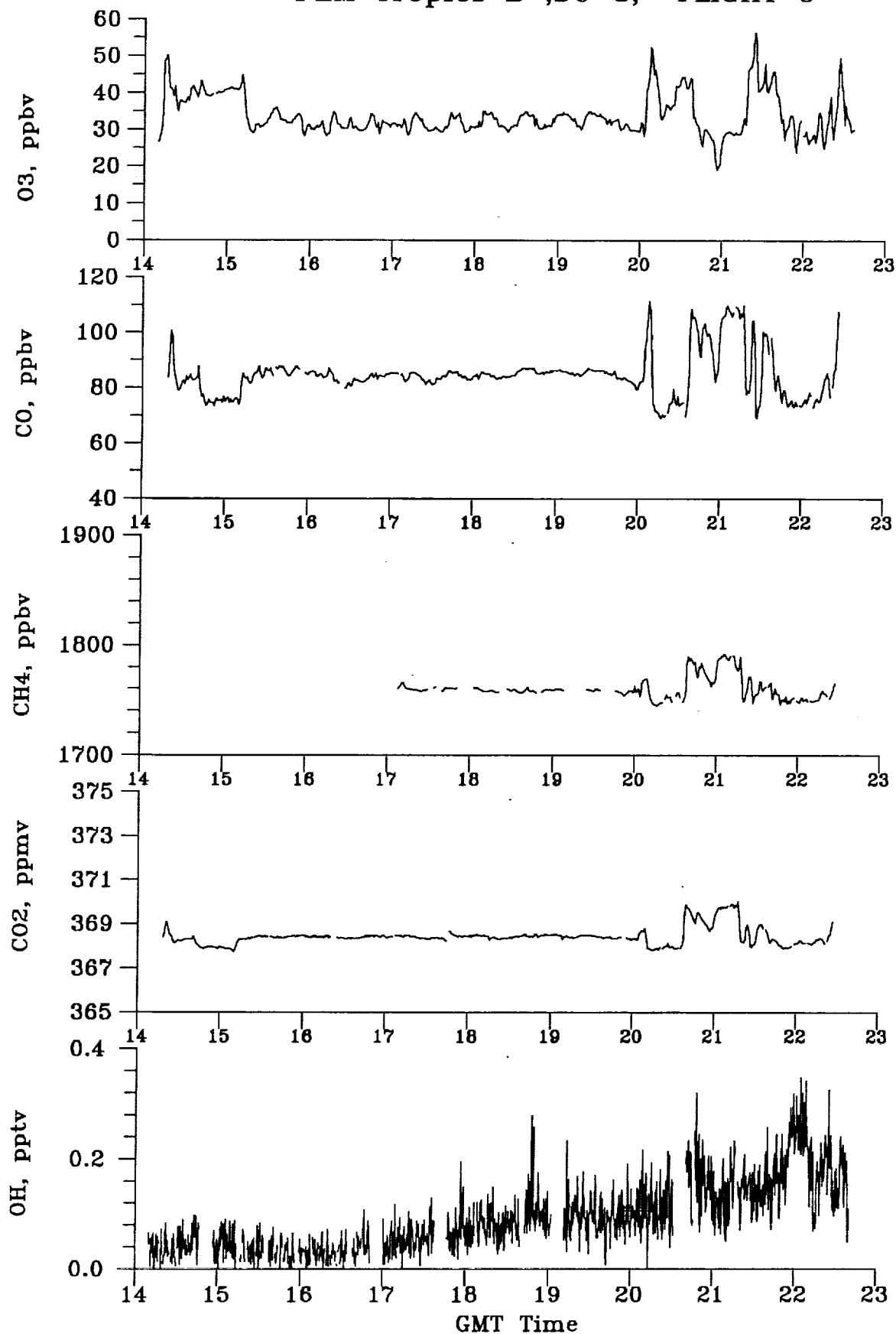
Sunrise Photochemistry

March 9, 1999

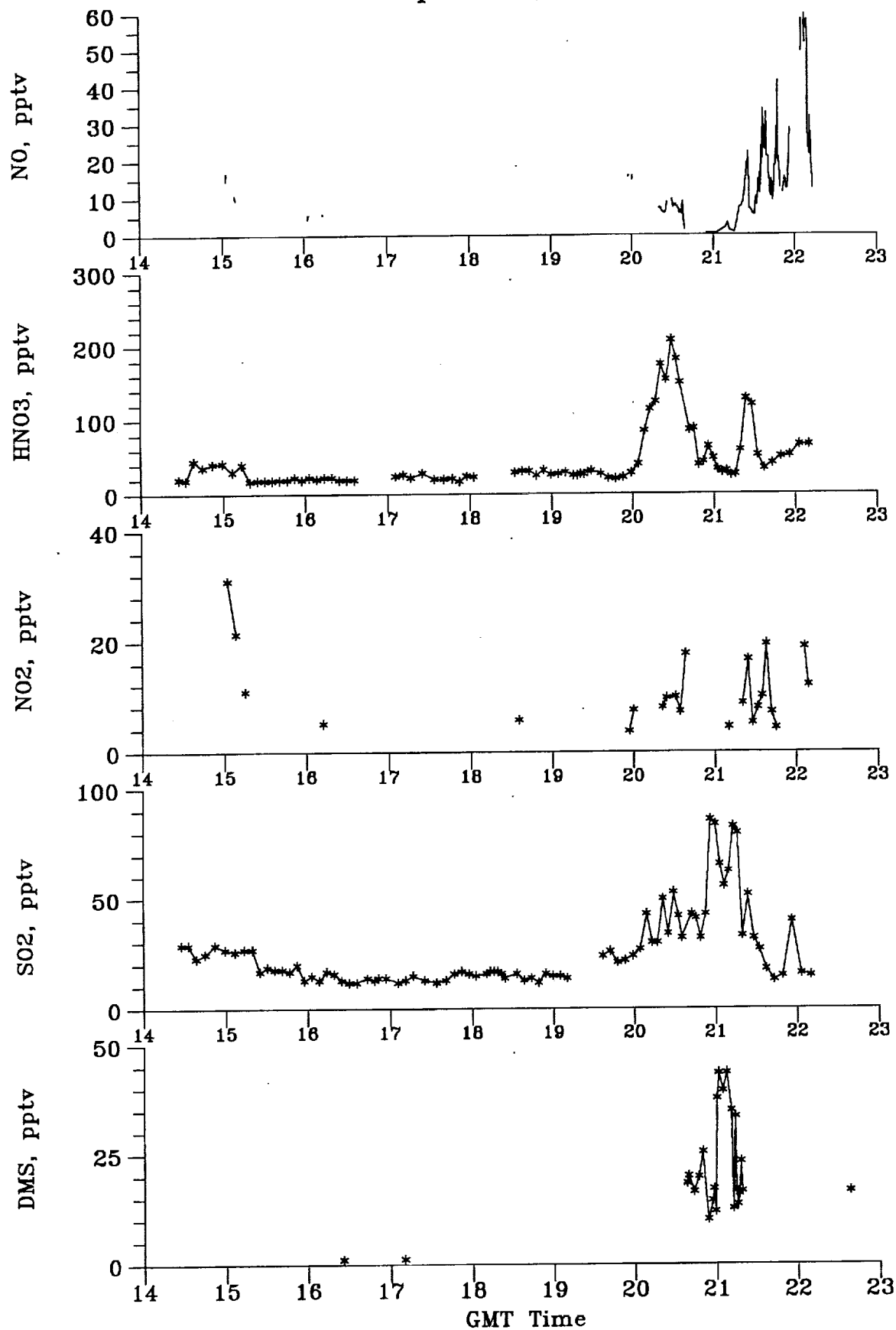
PEM Tropics B ;DC-8; FLIGHT 6



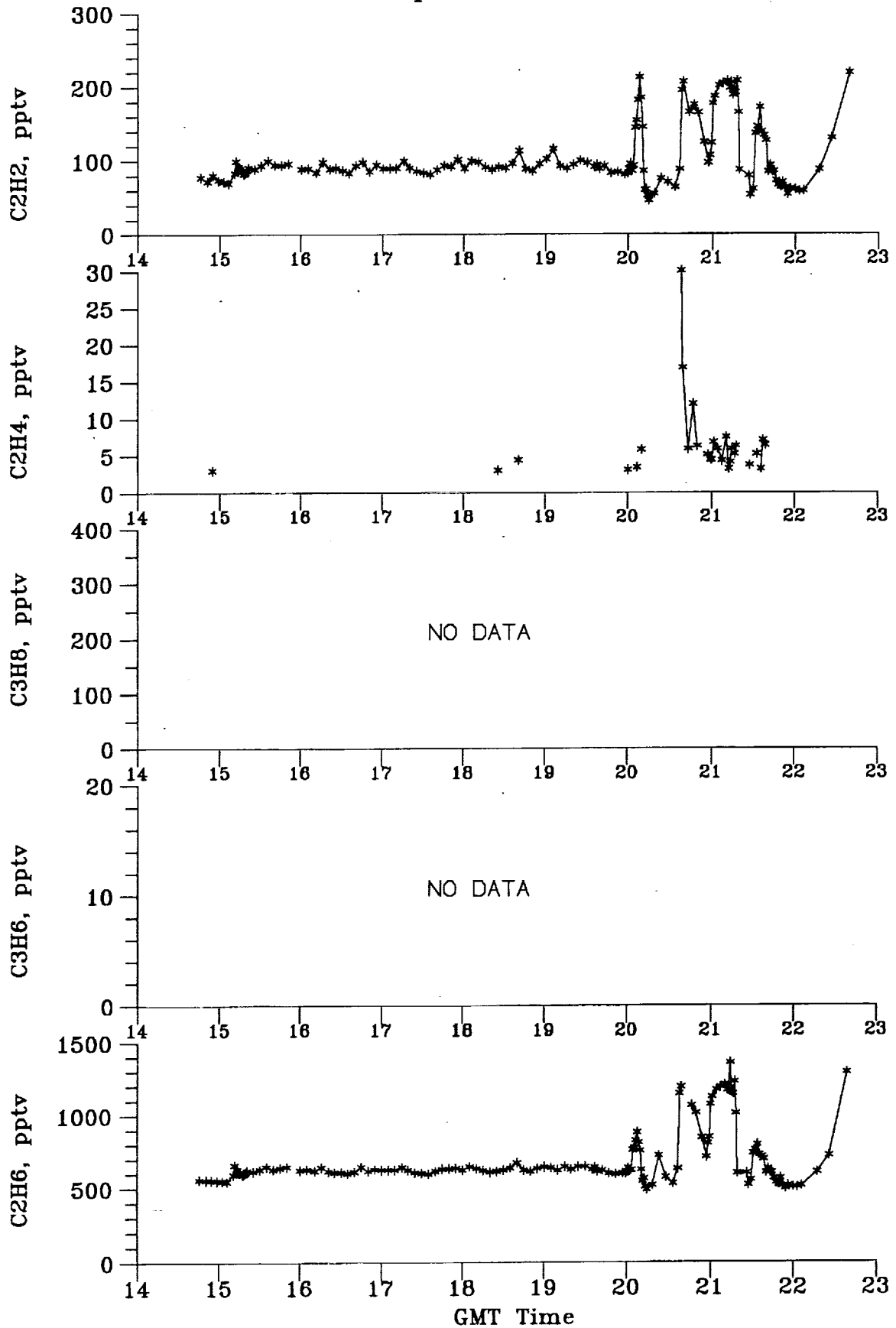
PEM Tropics B ;DC-8; FLIGHT 6



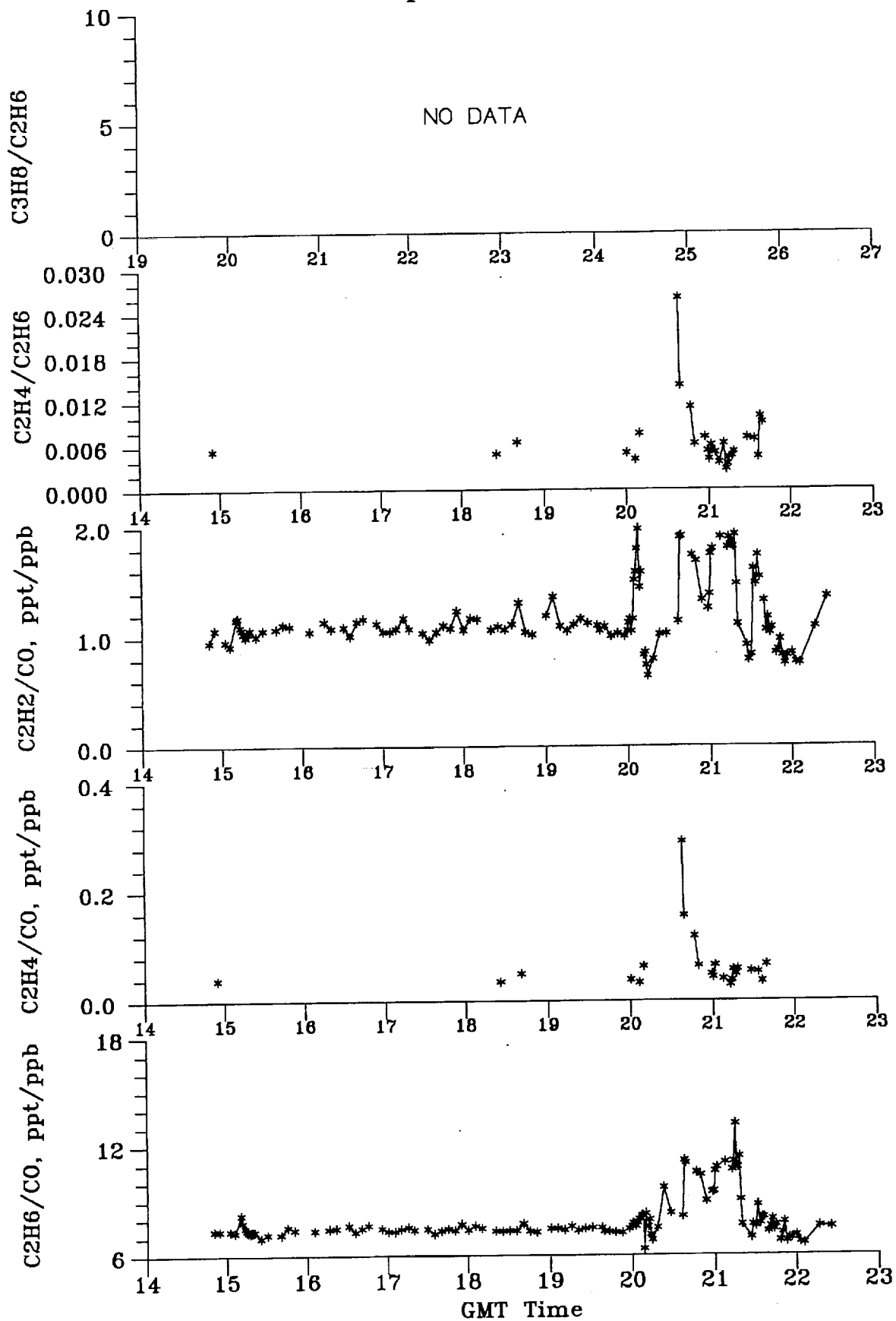
PEM Tropics B ;DC-8; FLIGHT 6



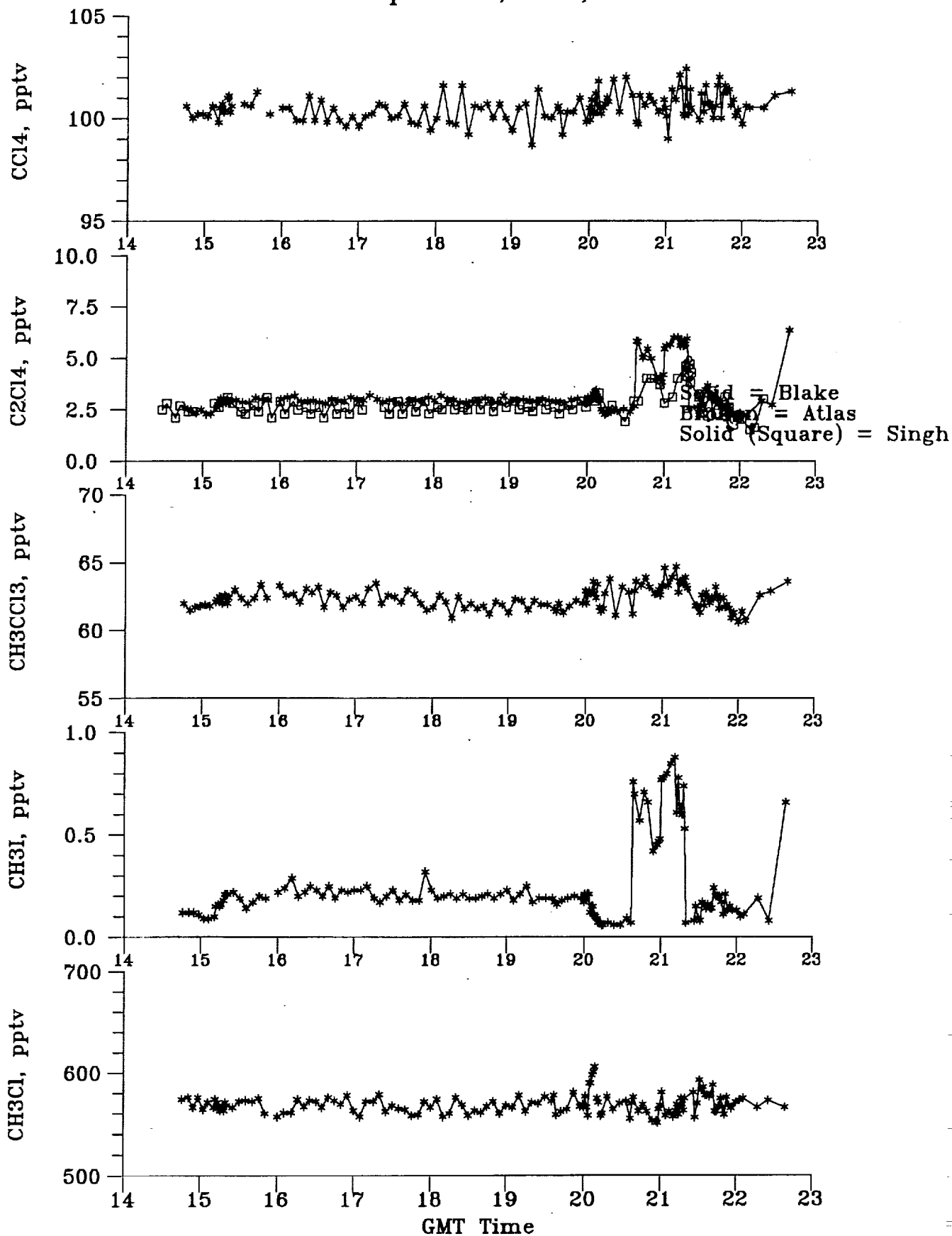
PEM Tropics B ;DC-8; FLIGHT 6



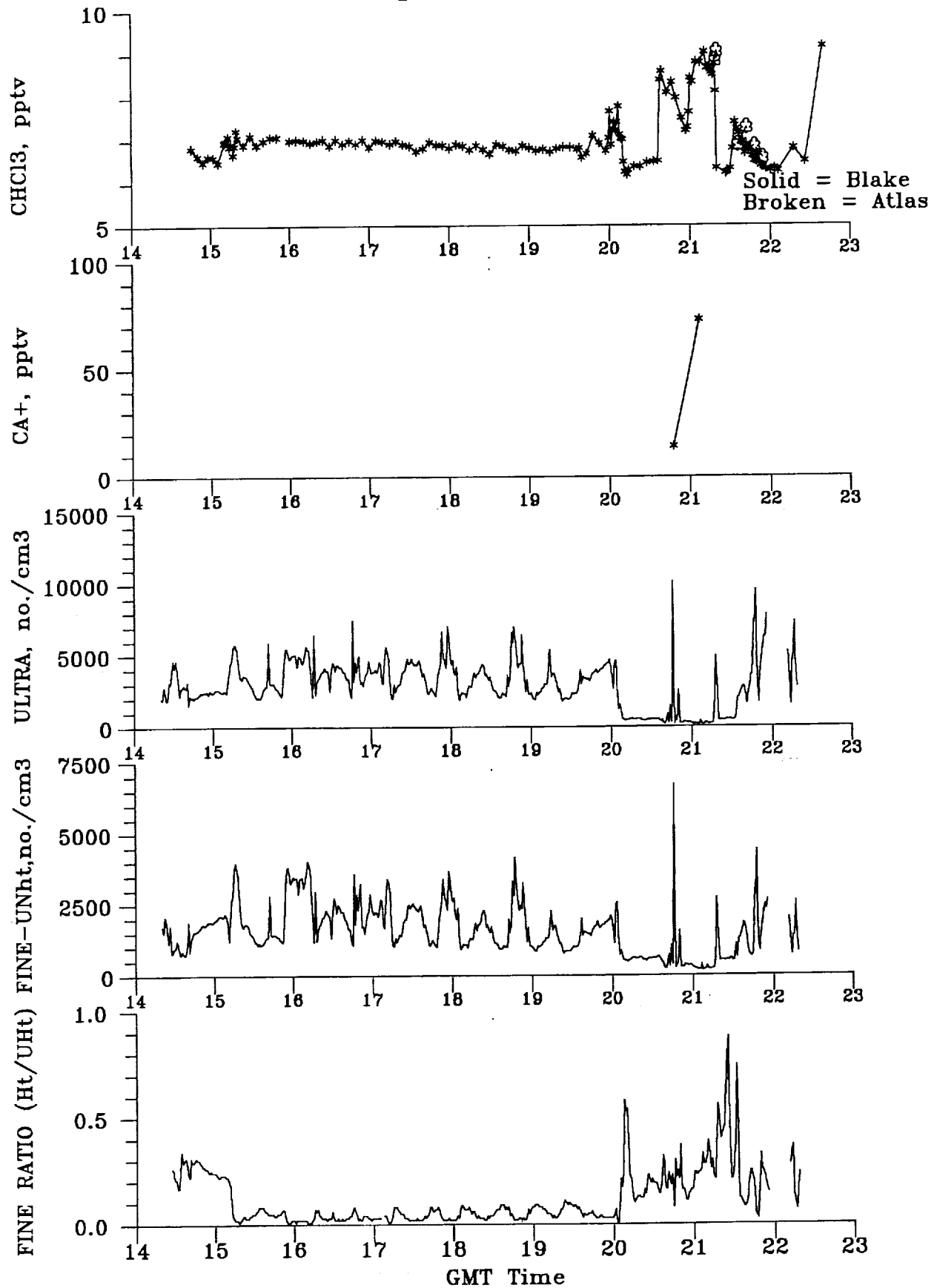
PEM Tropics B ;DC-8; FLIGHT 6



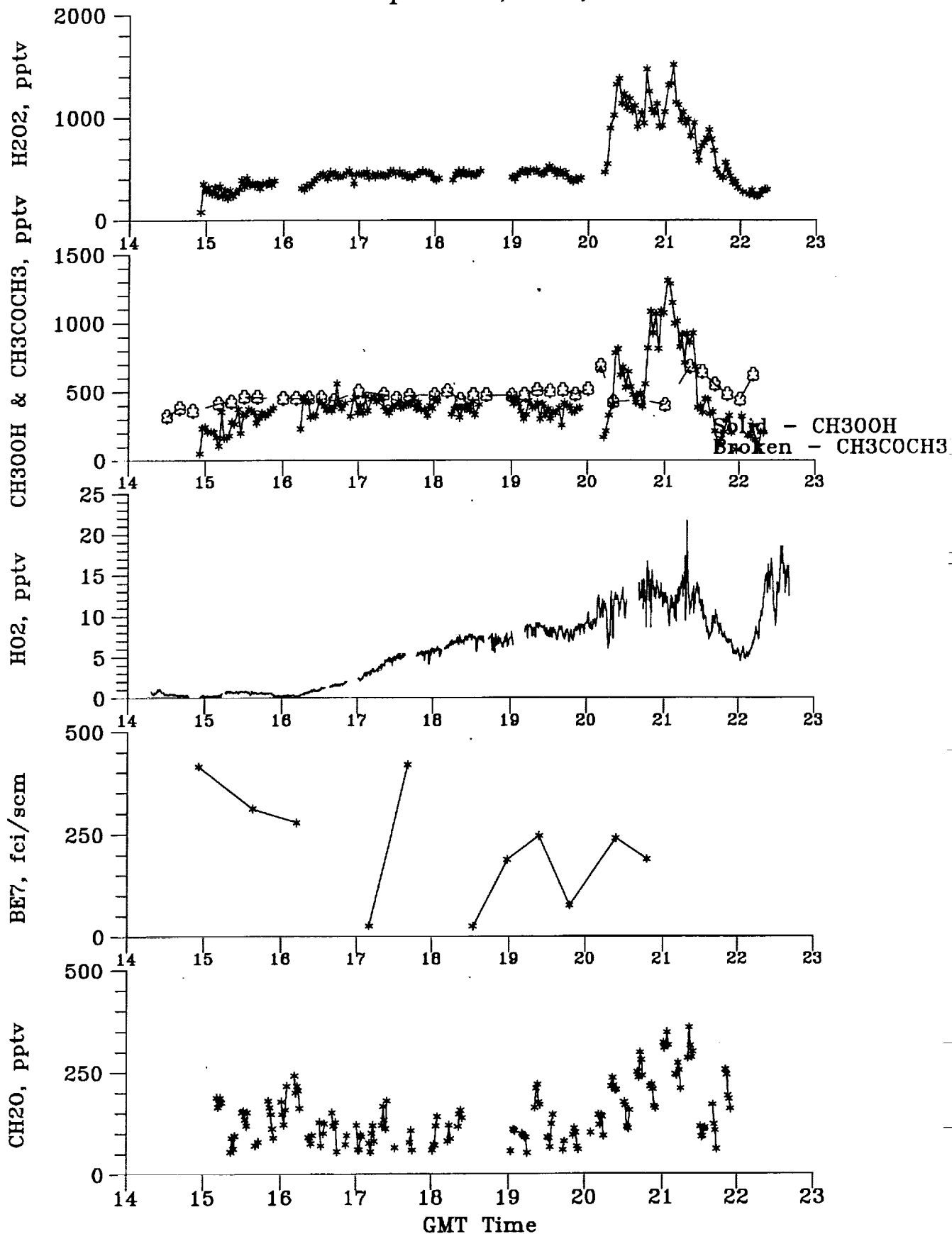
PEM Tropics B ;DC-8; FLIGHT 6



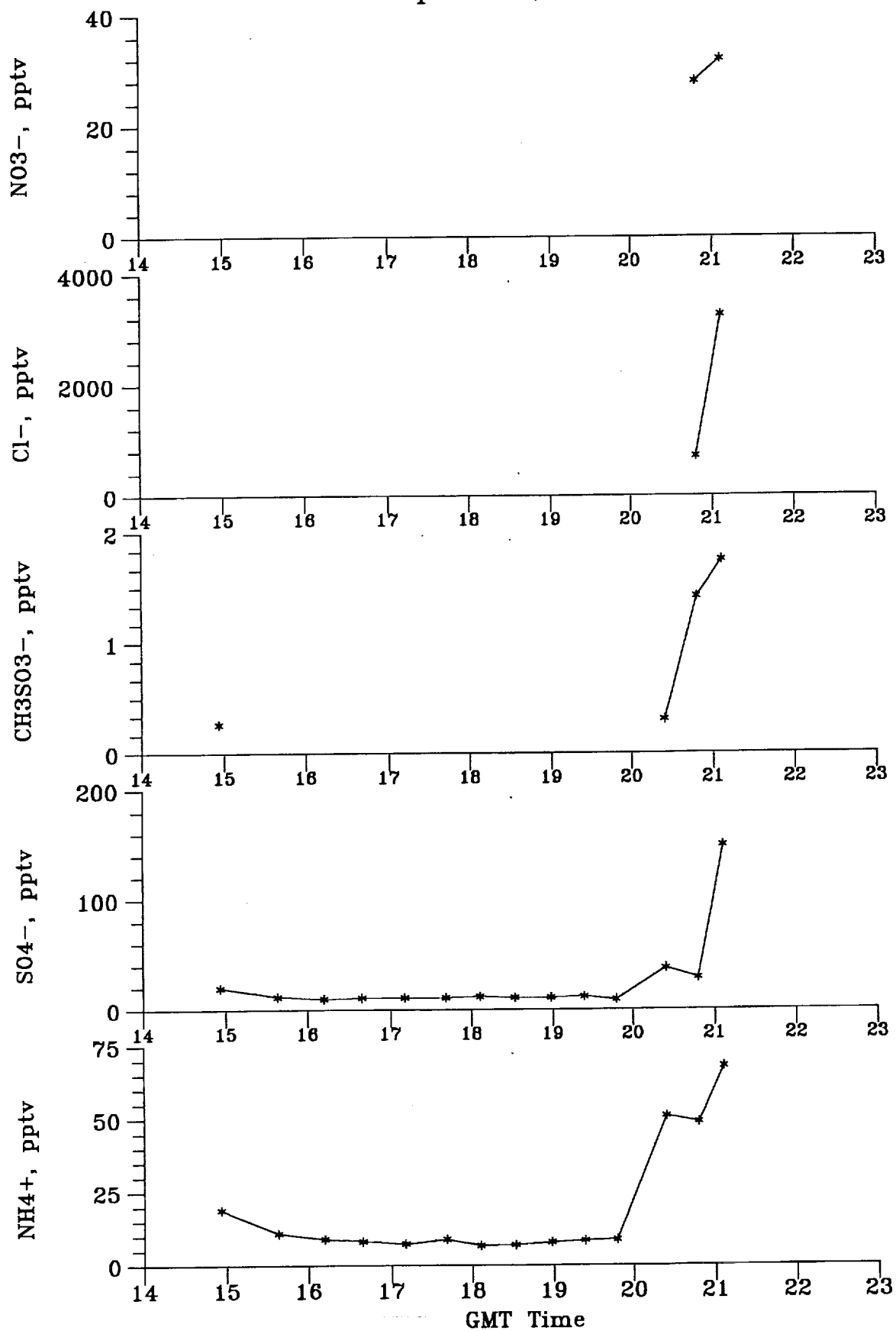
PEM Tropics B ;DC-8; FLIGHT 6



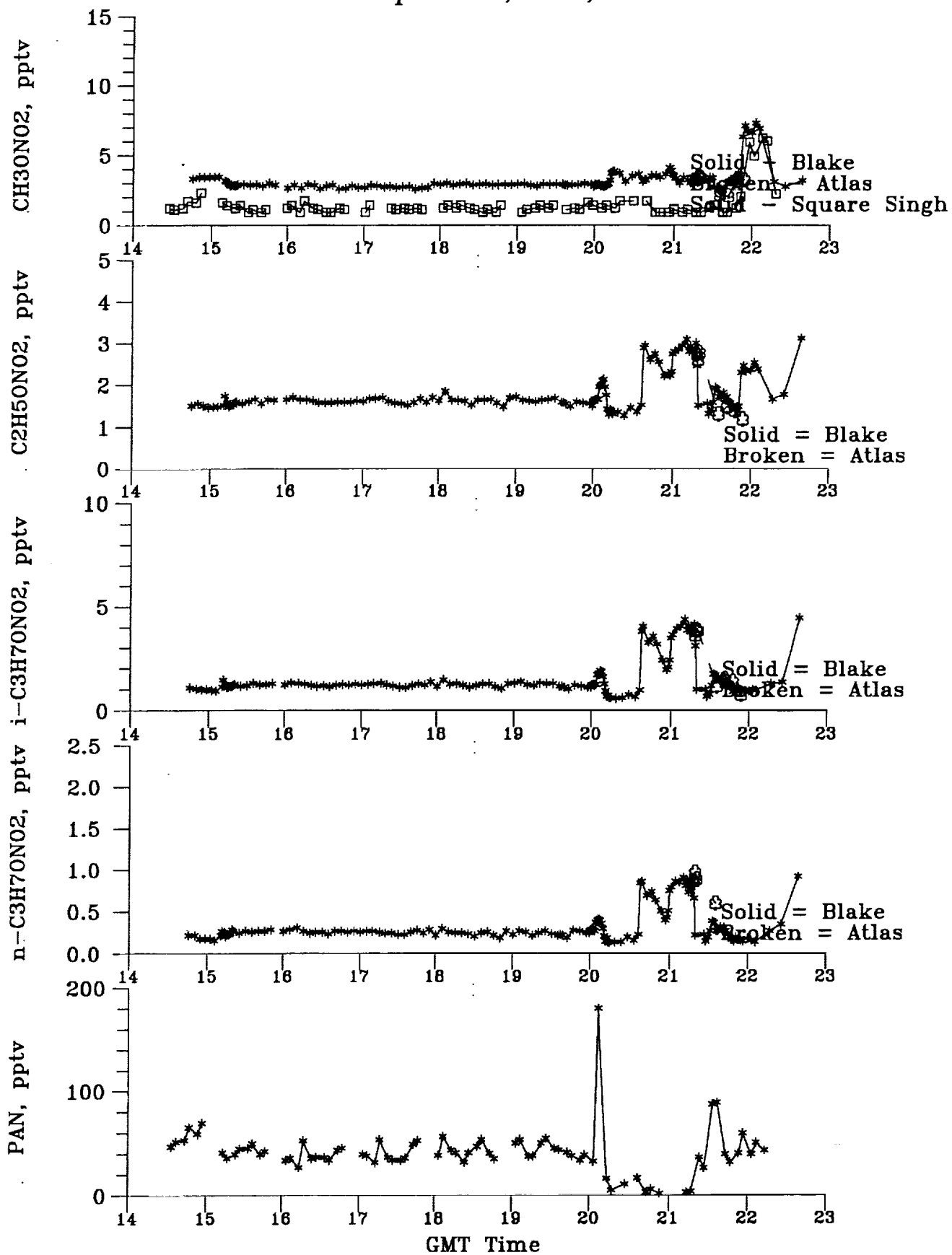
PEM Tropics B ;DC-8; FLIGHT 6



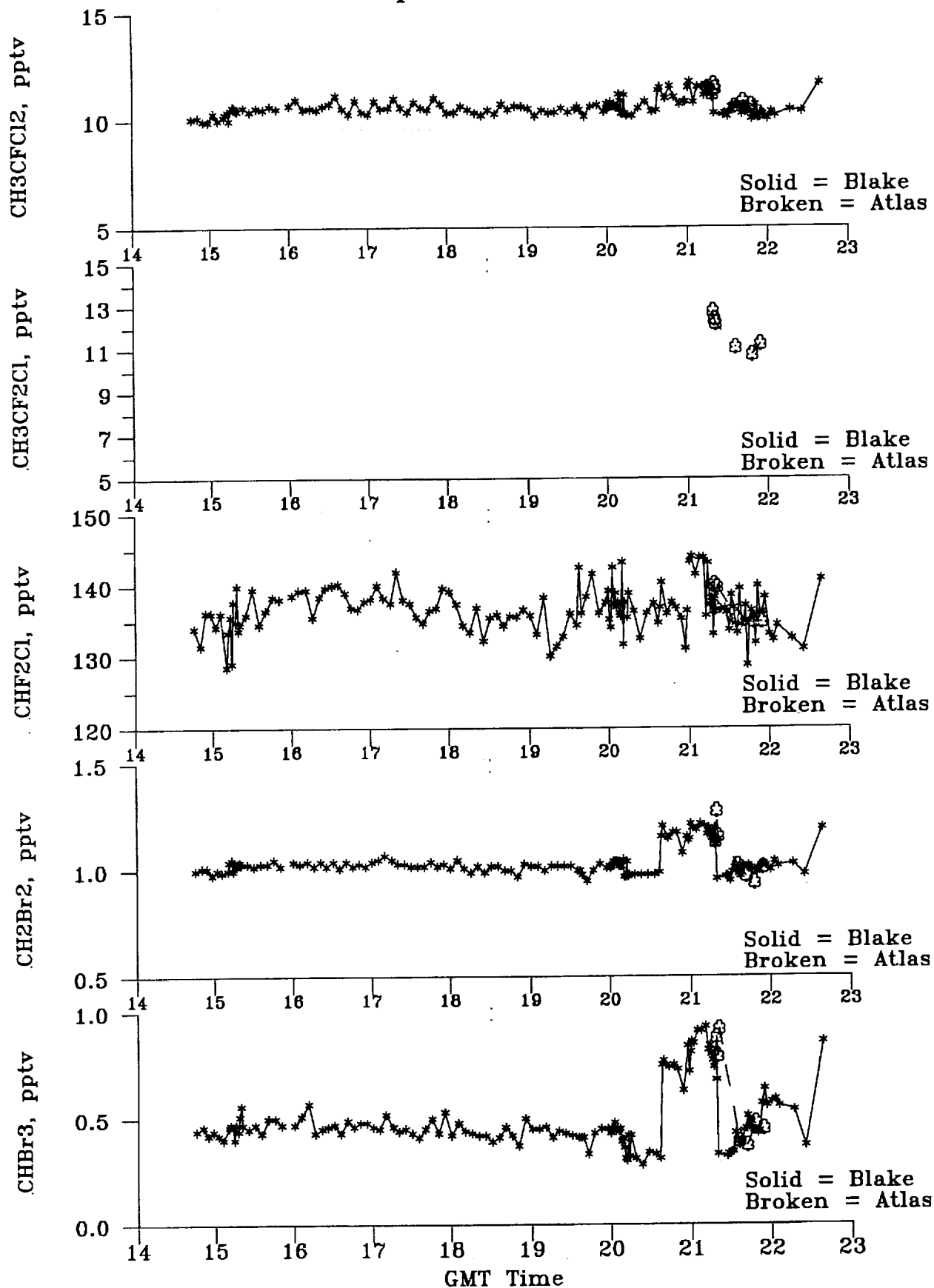
PEM Tropics B ;DC-8; FLIGHT 6



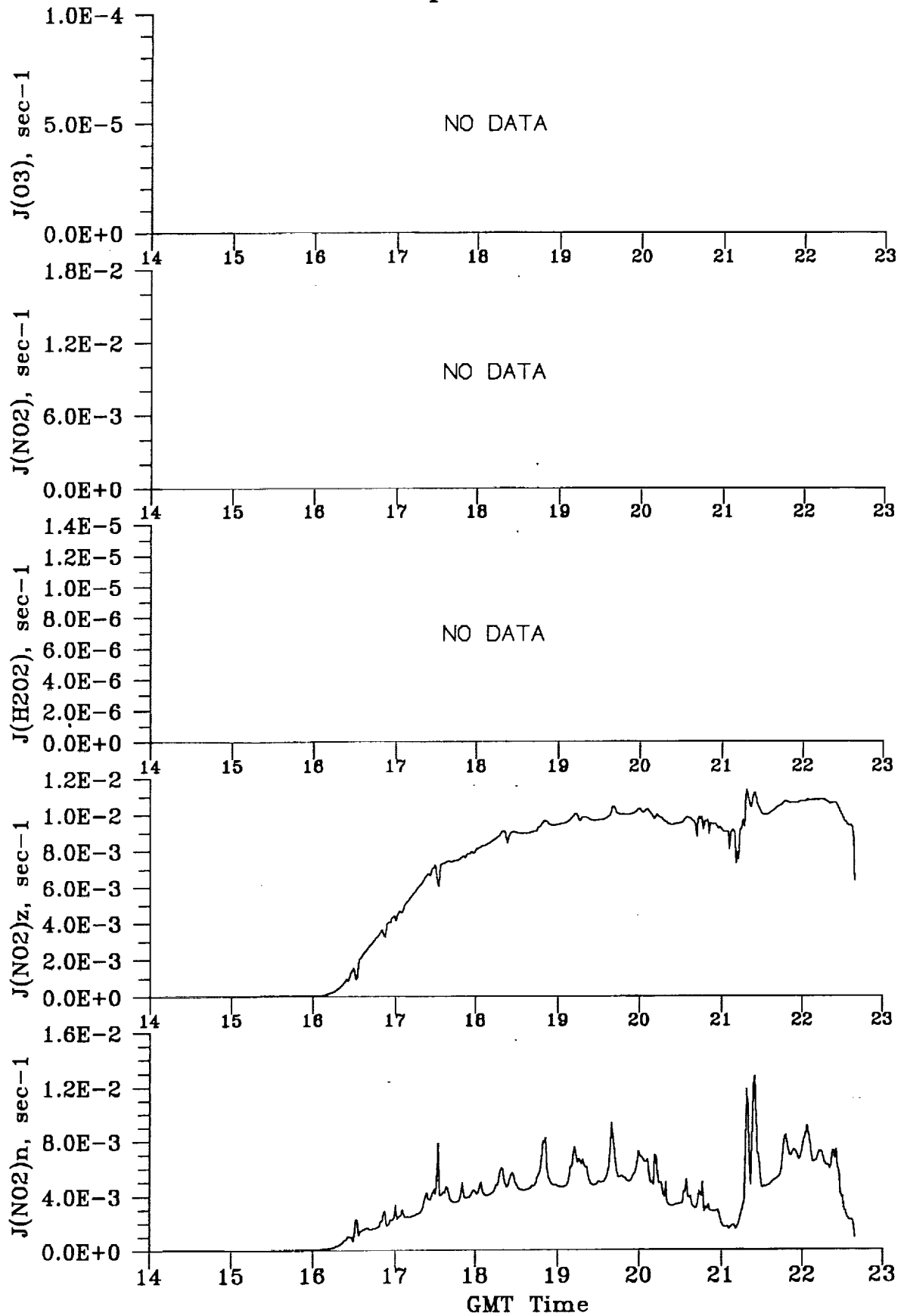
PEM Tropics B ;DC-8; FLIGHT 6



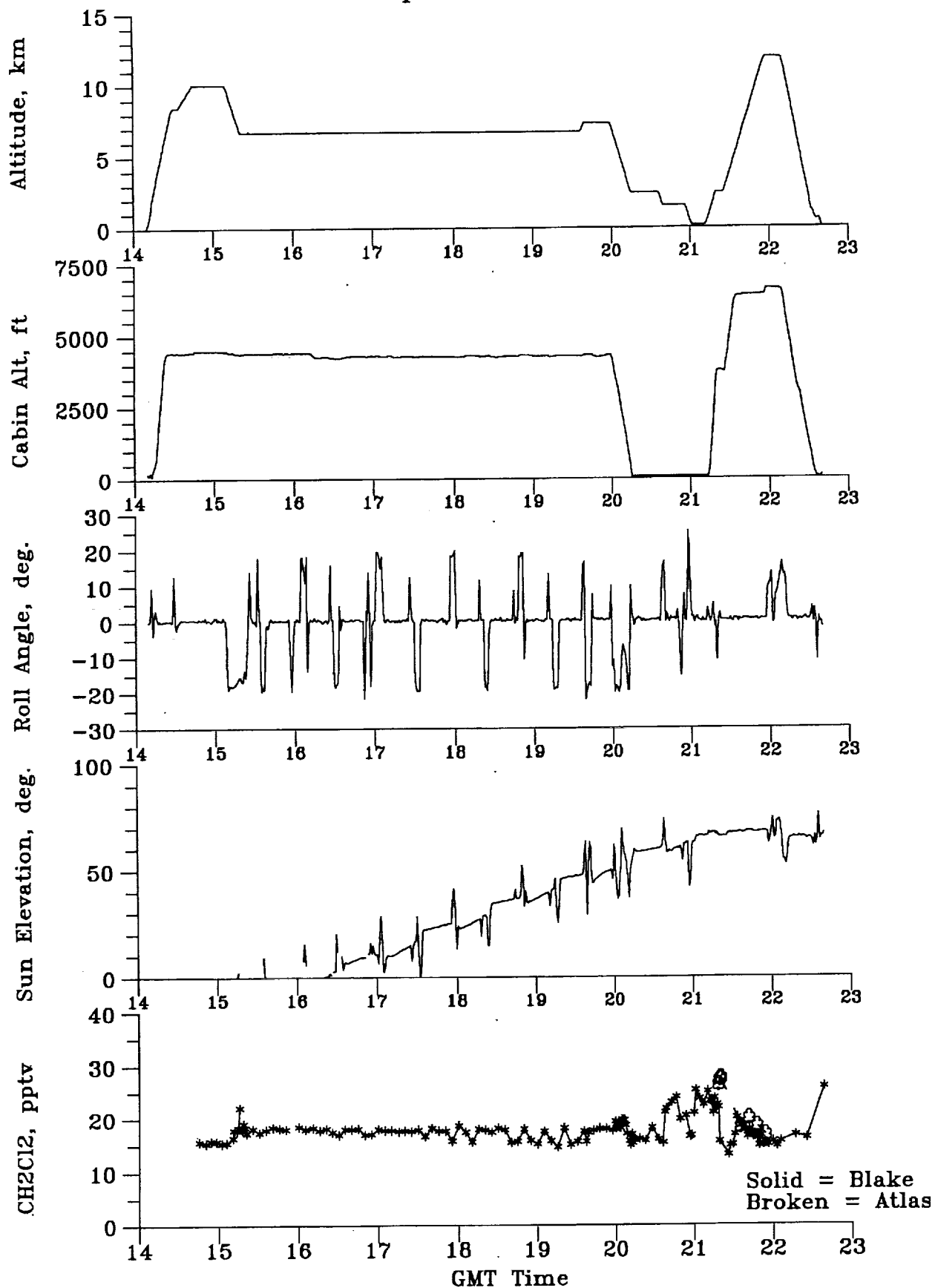
PEM Tropics B ;DC-8; FLIGHT 6



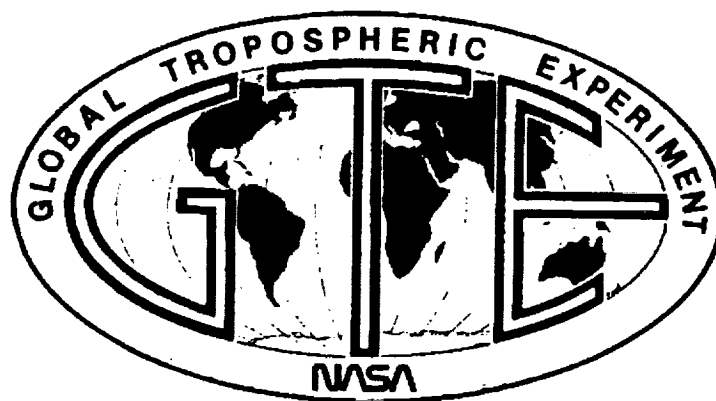
PEM Tropics B ;DC-8; FLIGHT 6



PEM Tropics B ;DC-8; FLIGHT 6



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

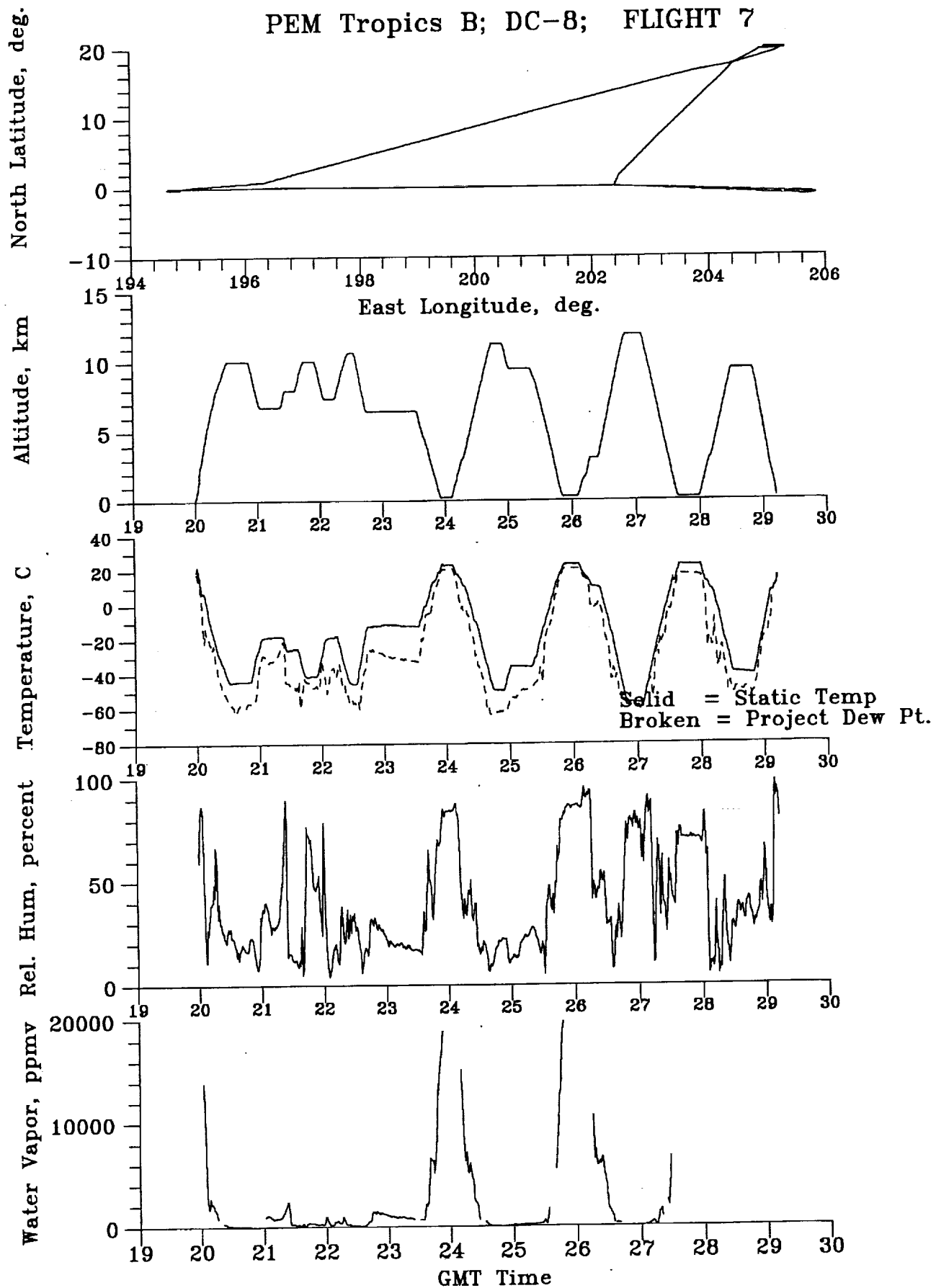
Flight 7D

Local: Hilo No. 2

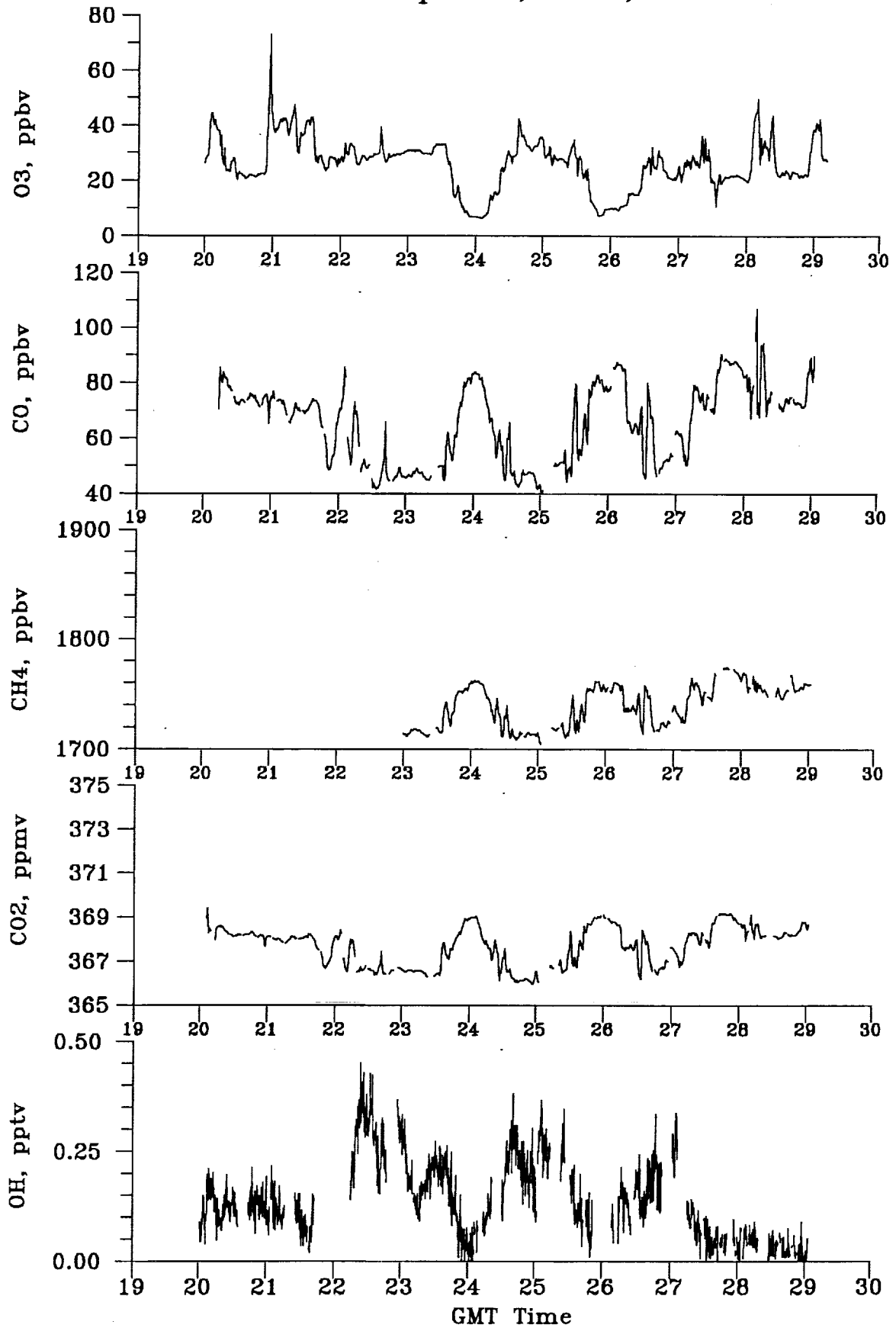
Equatorial Chemistry

March 13, 1999

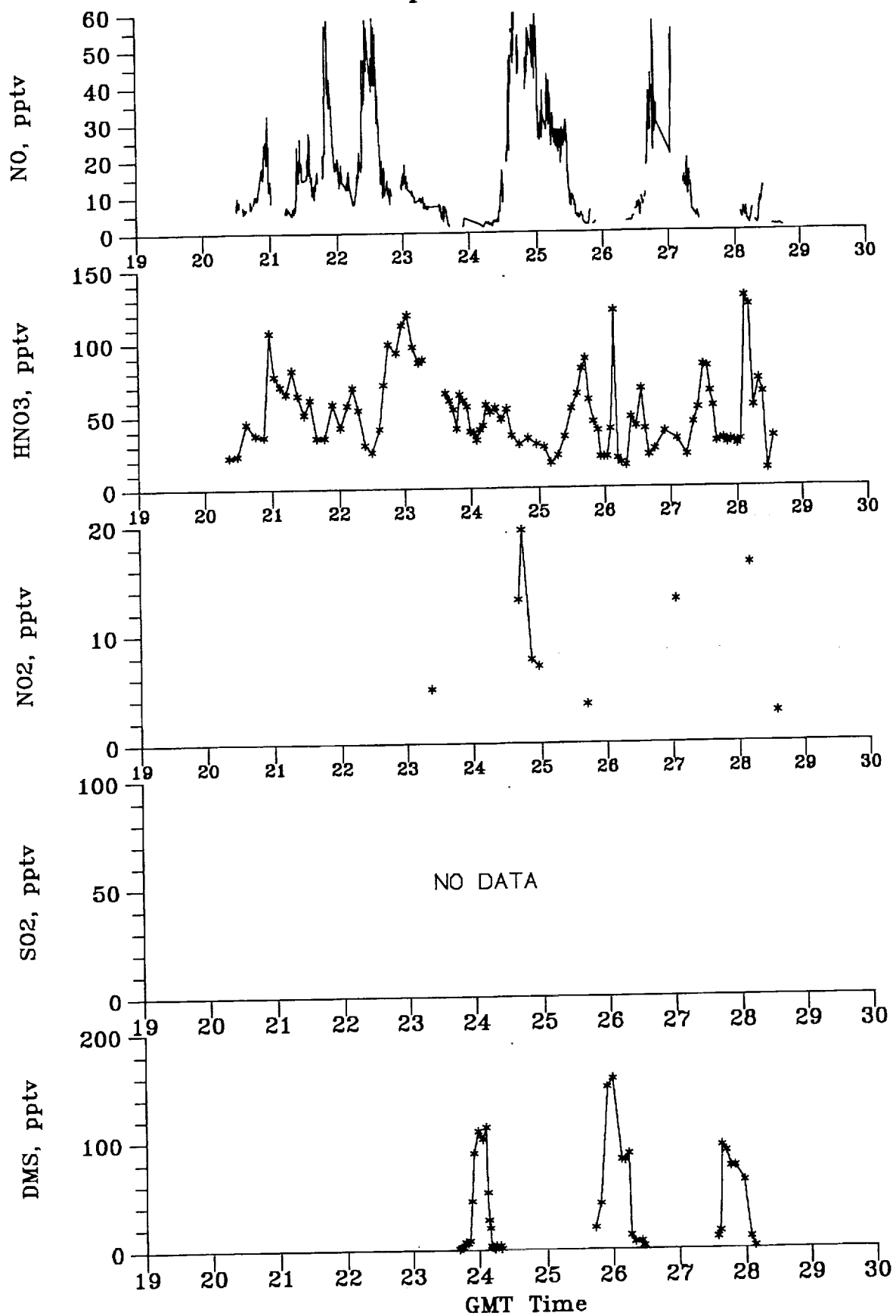
PEM Tropics B; DC-8; FLIGHT 7



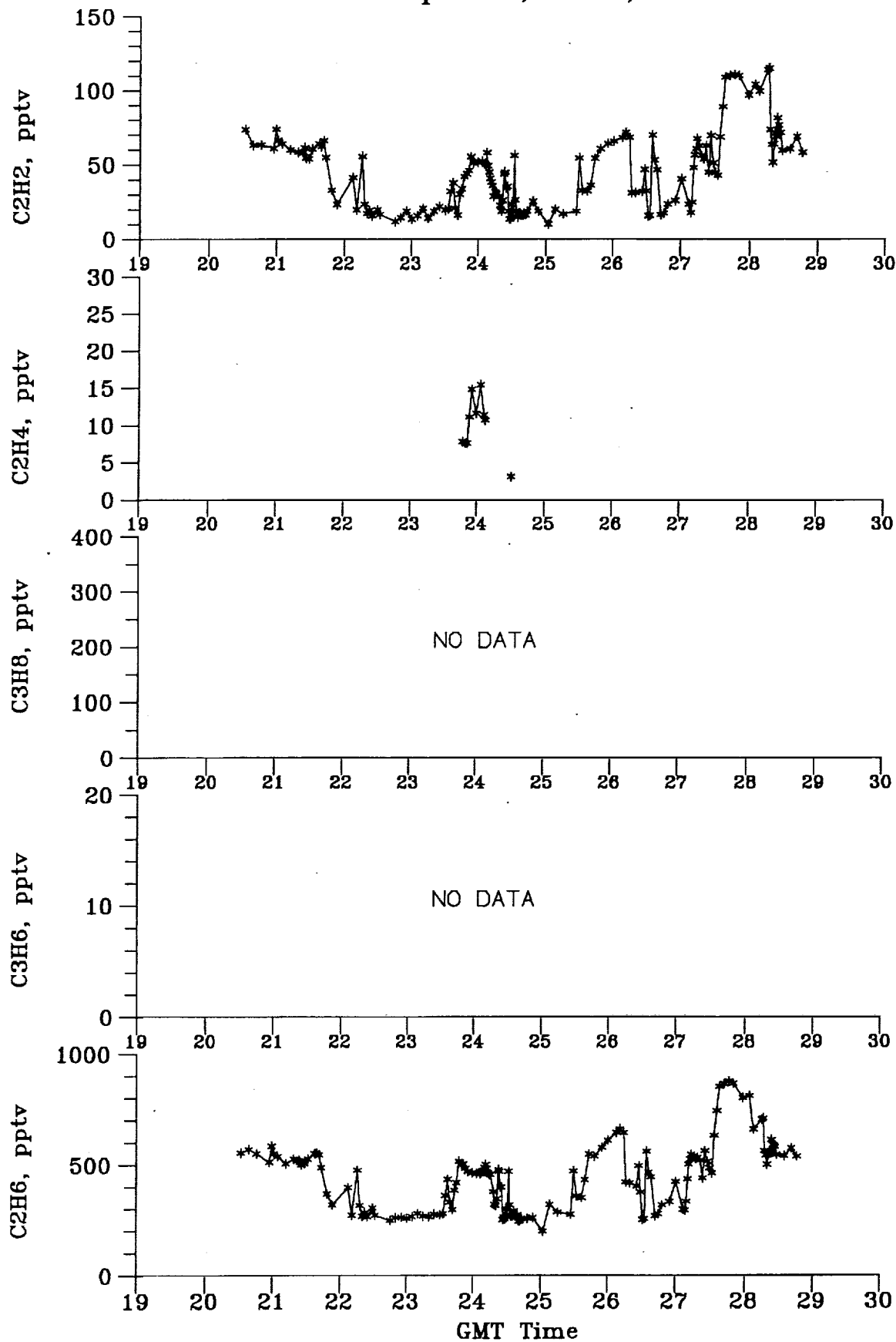
PEM Tropics B; DC-8; FLIGHT 7



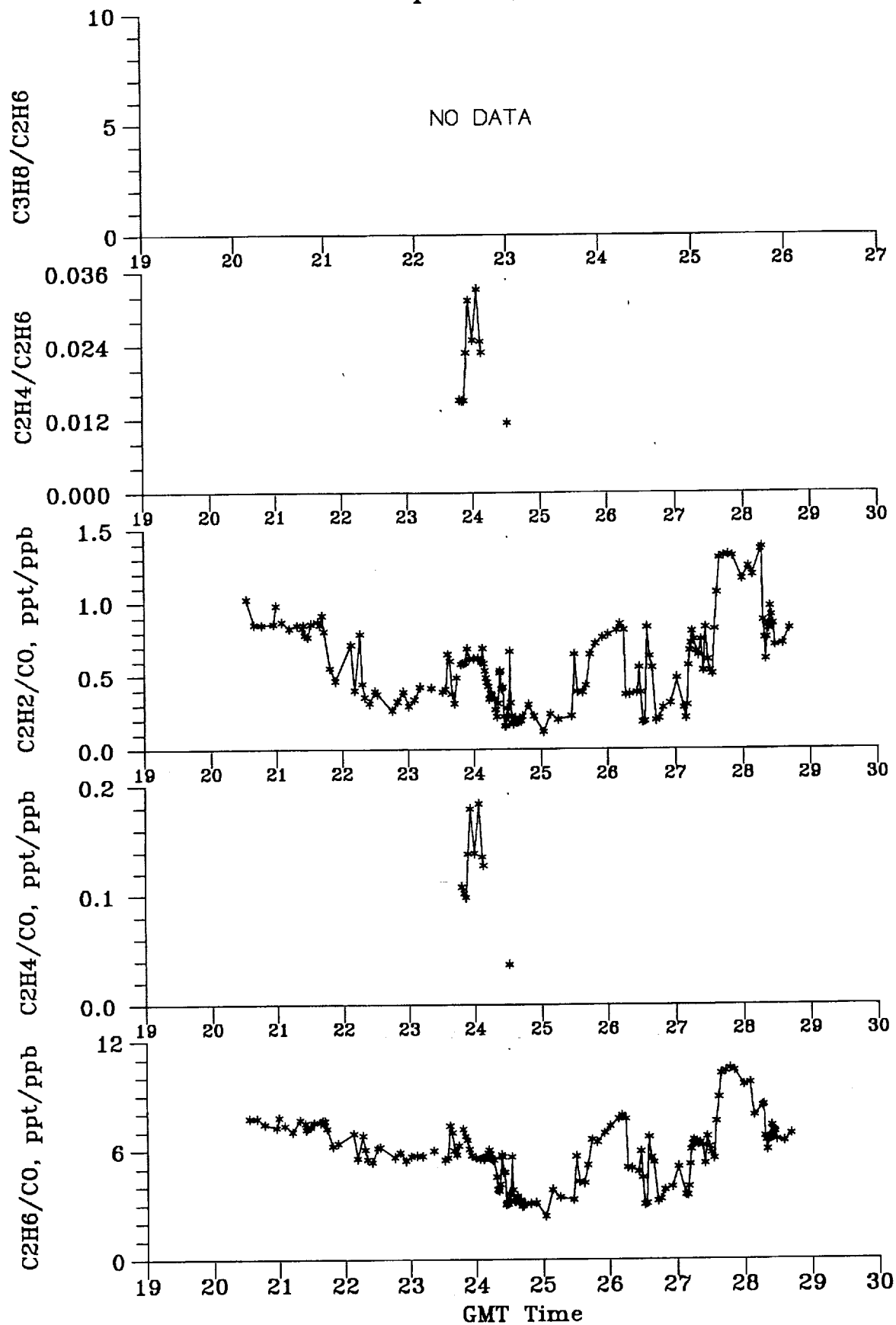
PEM Tropics B; DC-8; FLIGHT 7



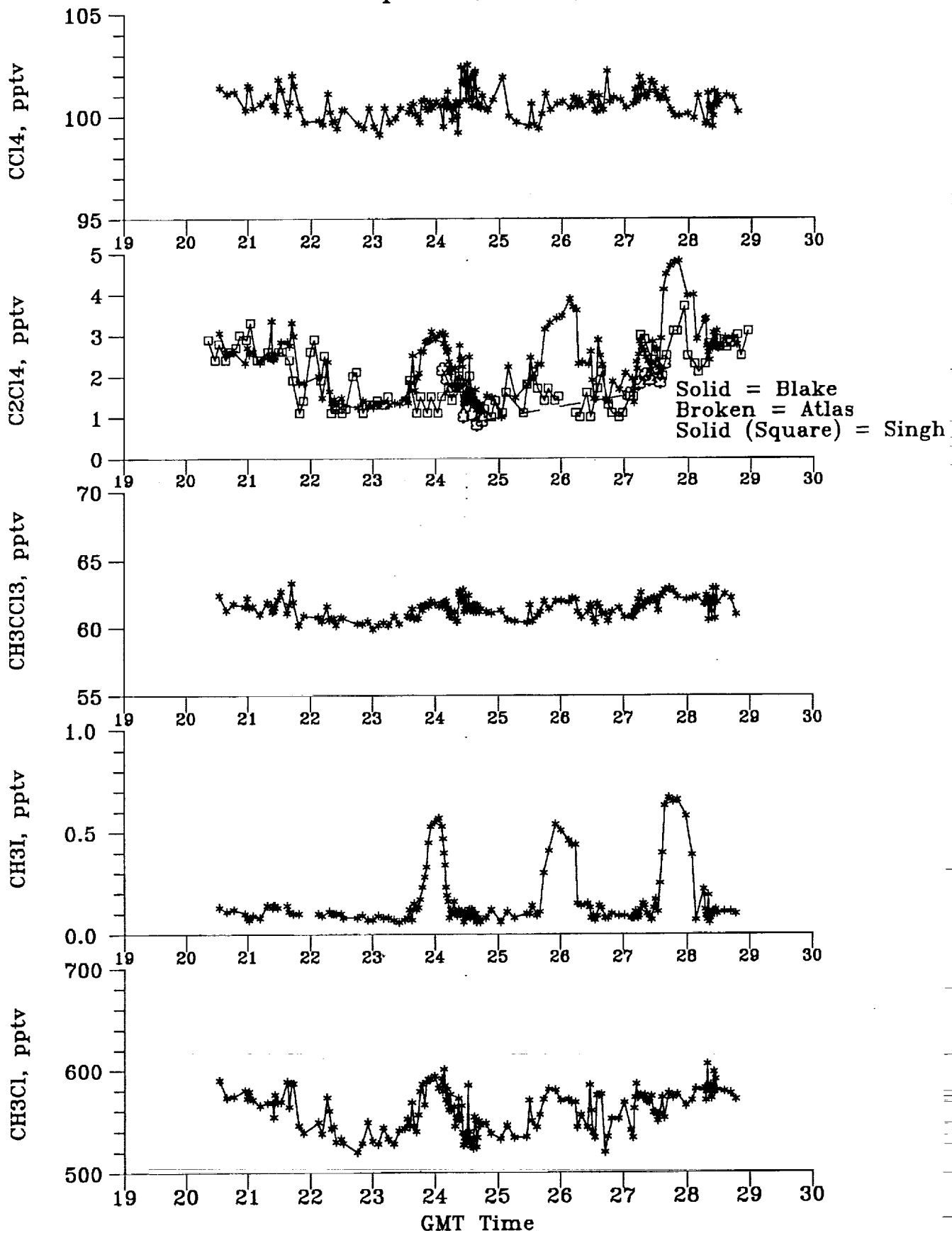
PEM Tropics B; DC-8; FLIGHT 7



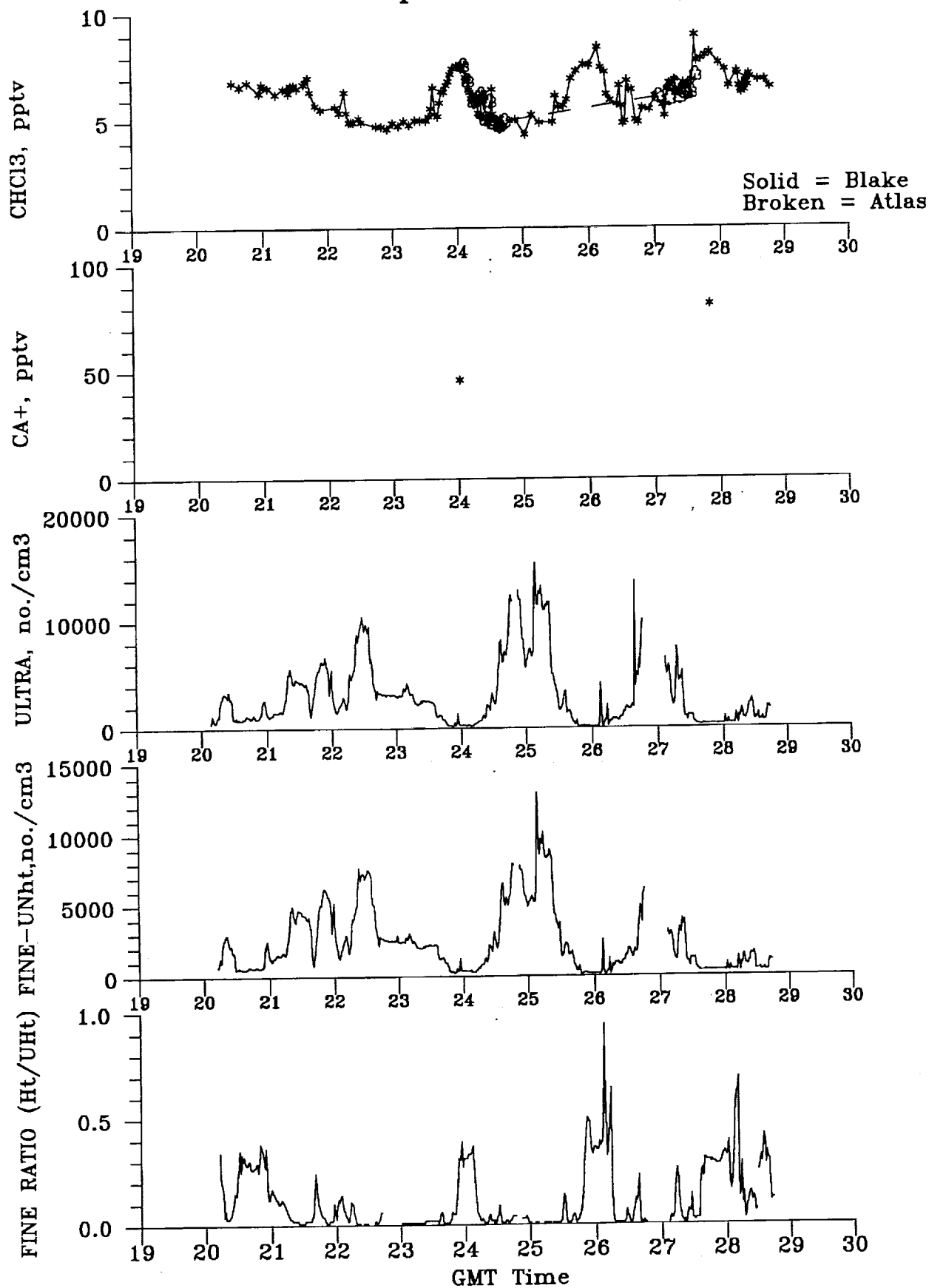
PEM Tropics B; DC-8; FLIGHT 7



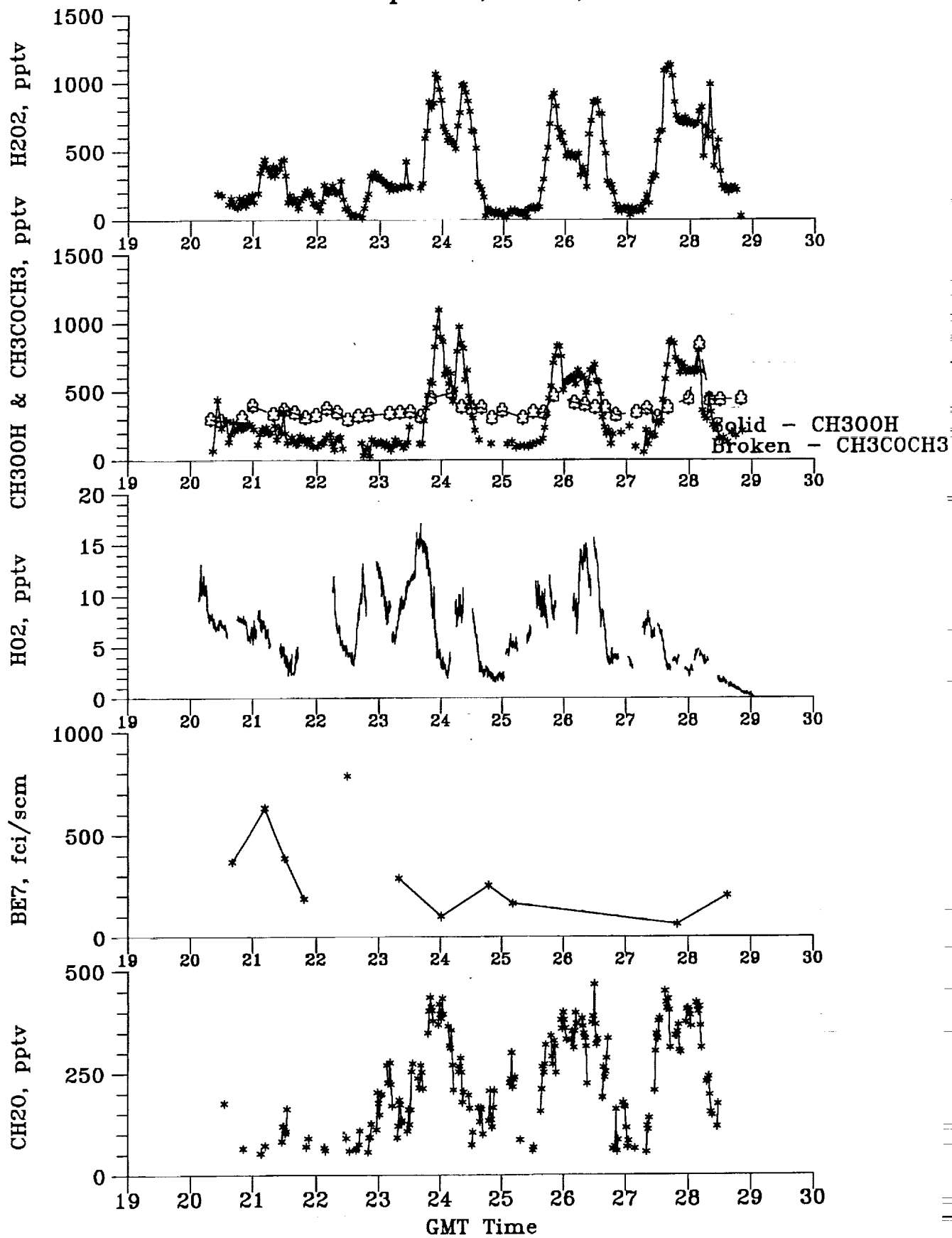
PEM Tropics B; DC-8; FLIGHT 7



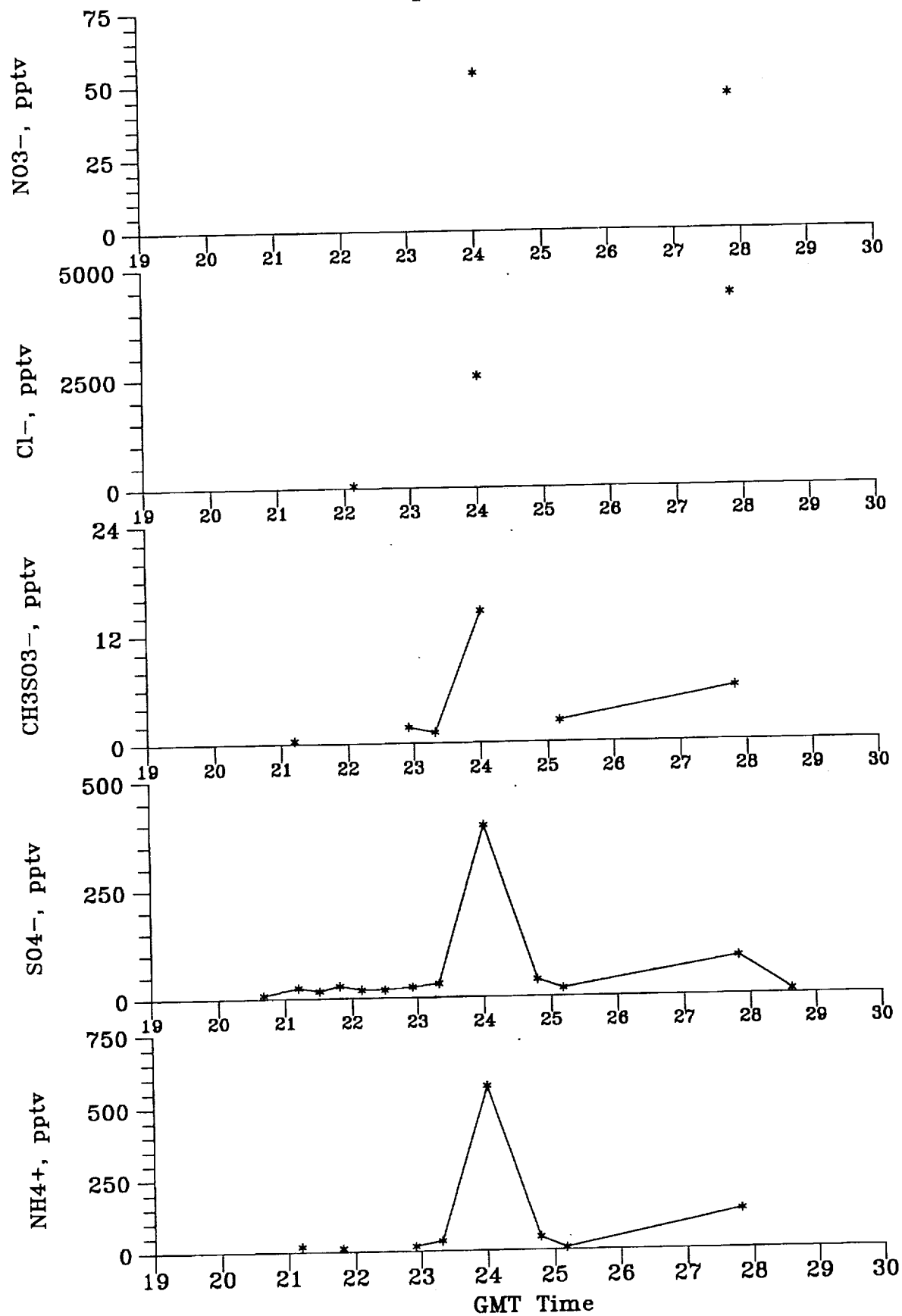
PEM Tropics B; DC-8; FLIGHT 7



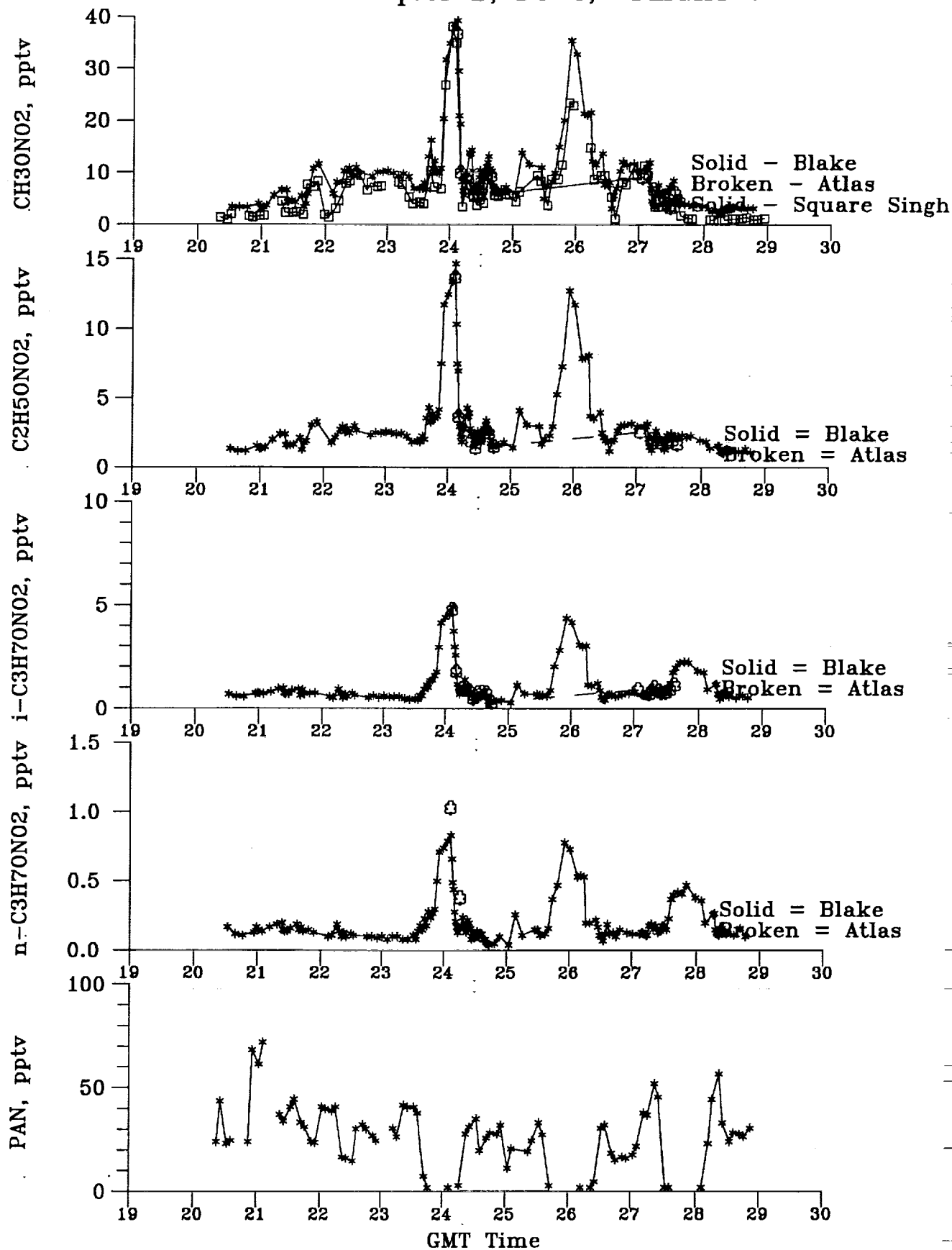
PEM Tropics B; DC-8; FLIGHT 7



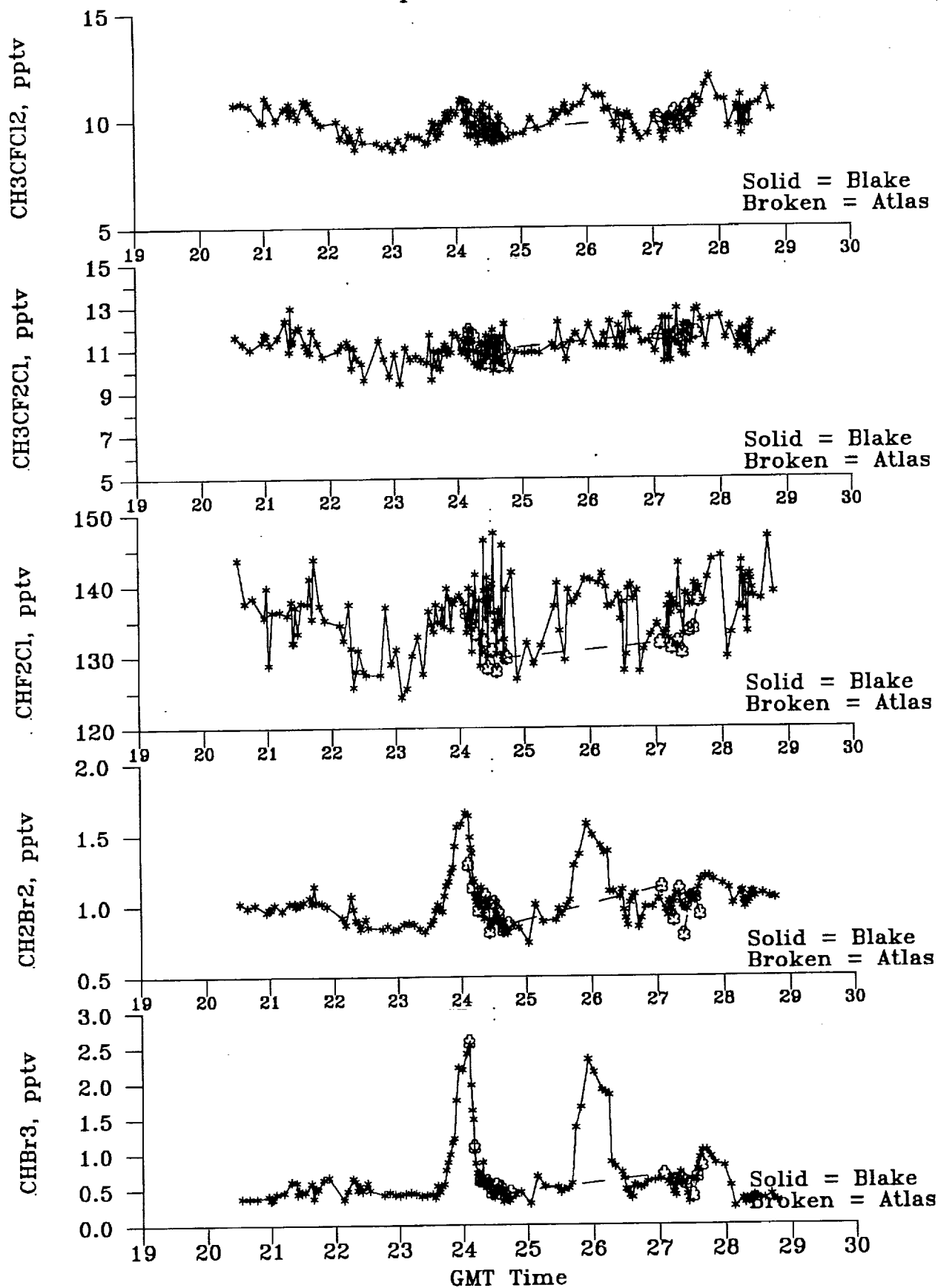
PEM Tropics B; DC-8; FLIGHT 7



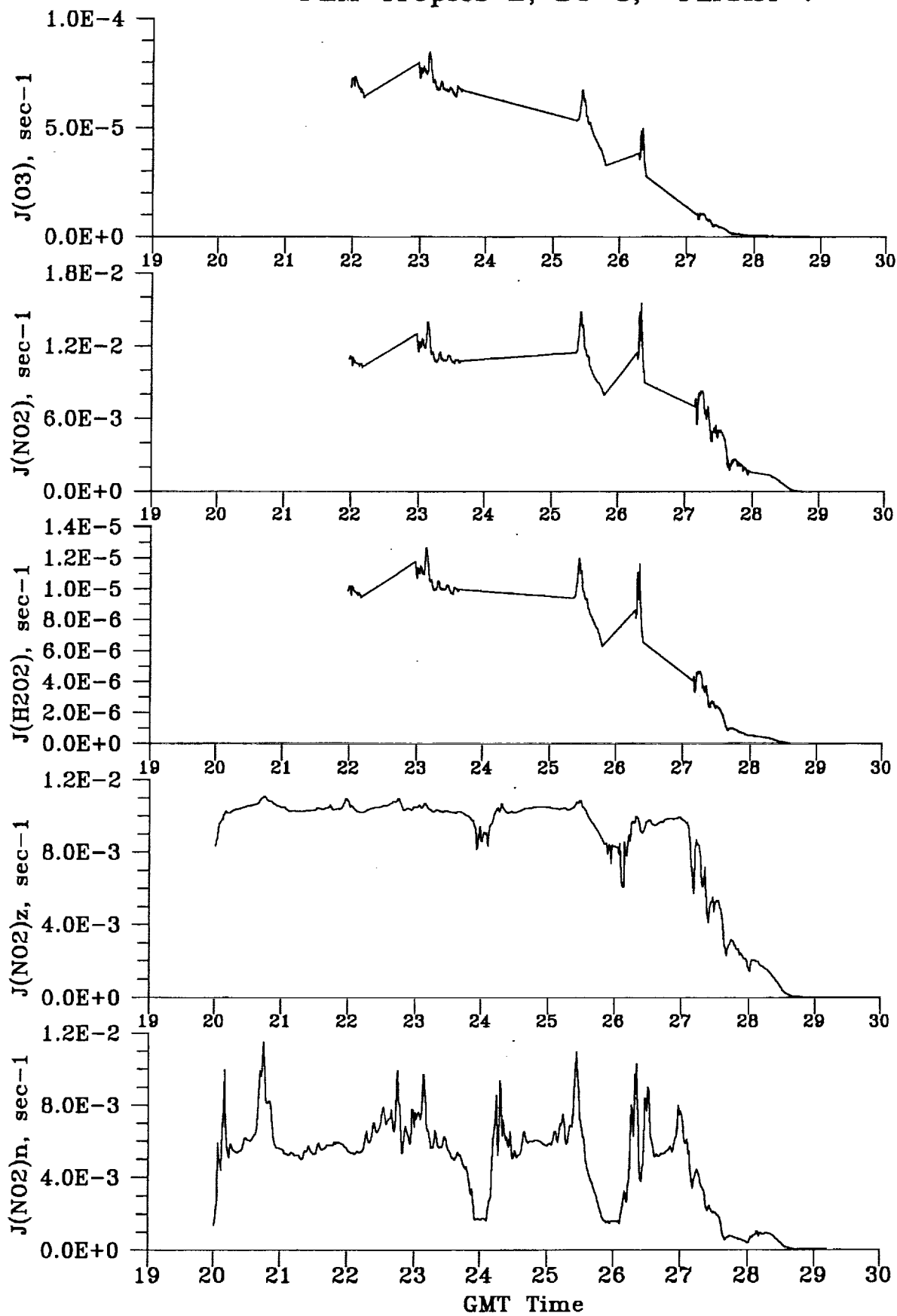
PEM Tropics B; DC-8; FLIGHT 7



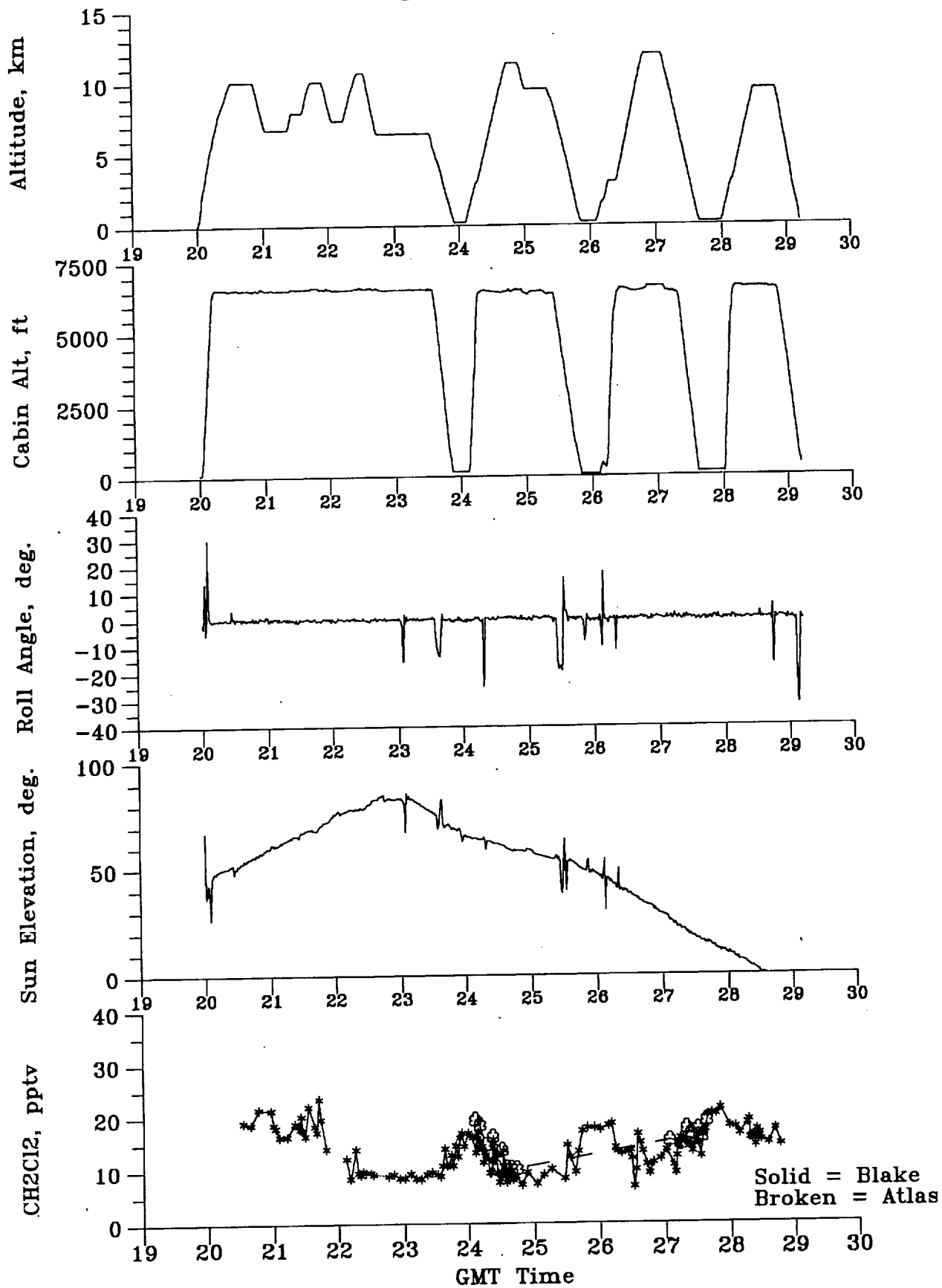
PEM Tropics B; DC-8; FLIGHT 7



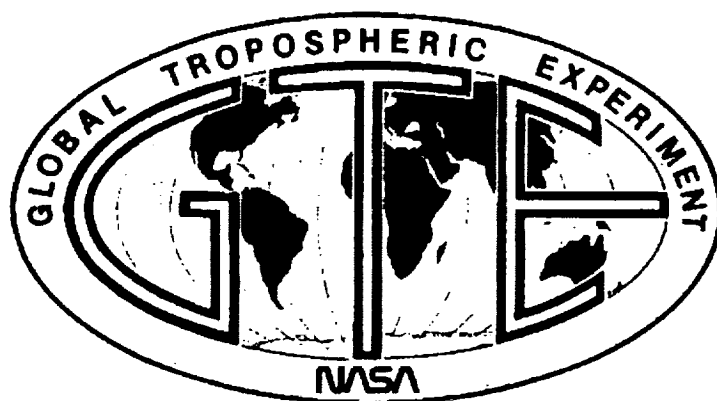
PEM Tropics B; DC-8; FLIGHT 7



PEM Tropics B; DC-8; FLIGHT 7



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

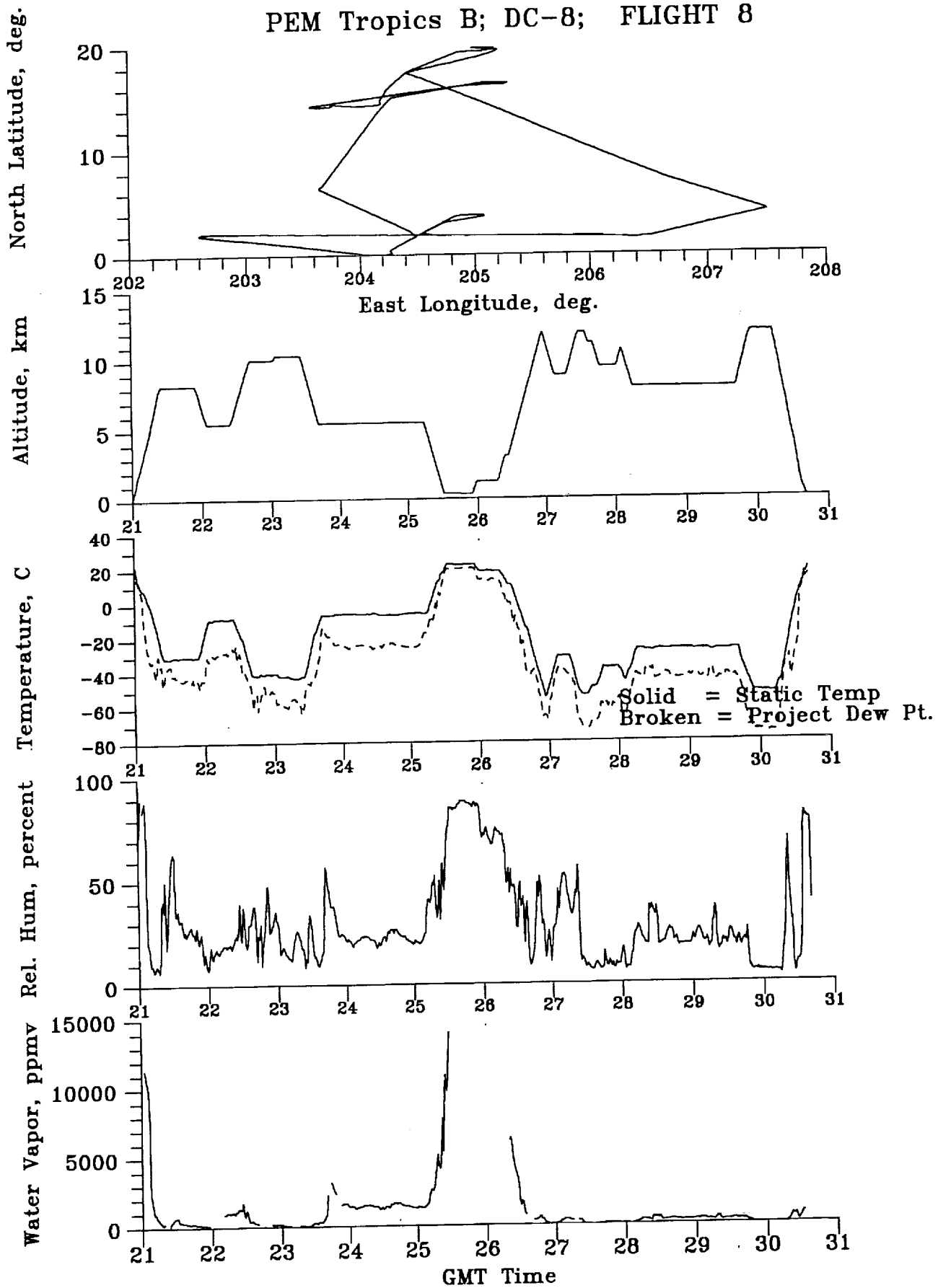
Flight 8D

Local: Hilo No. 3

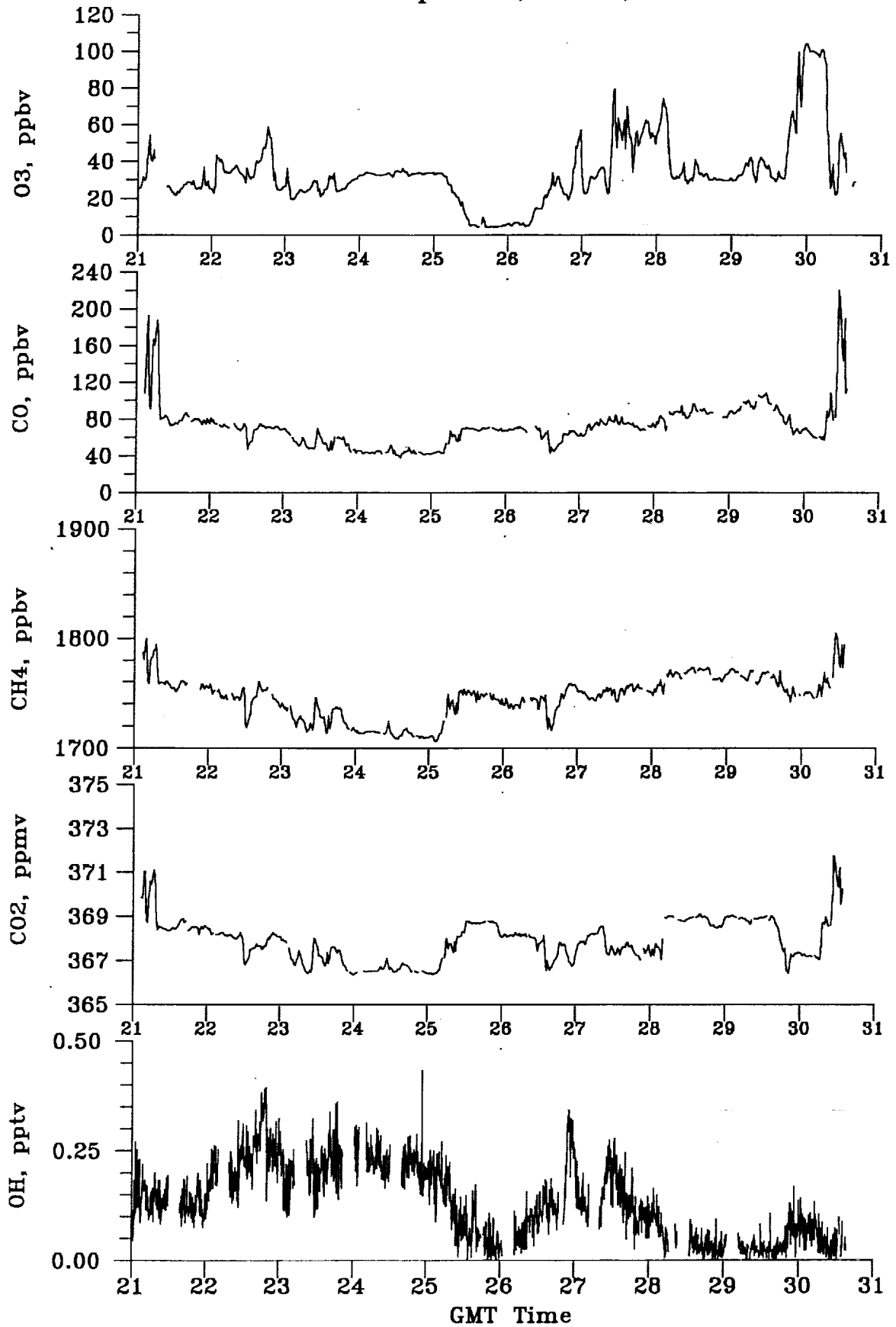
Sunset Photochemistry

March 15, 1999

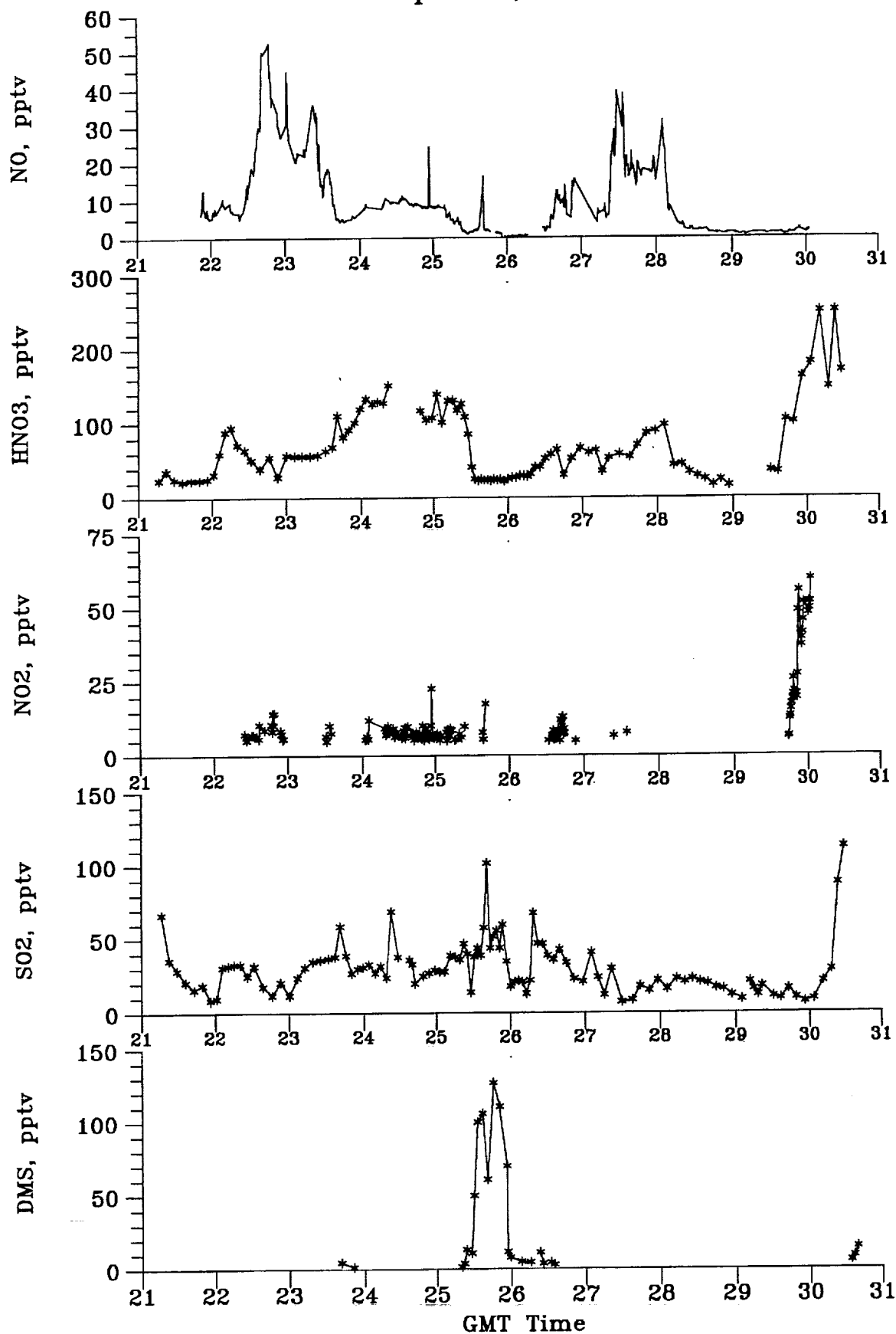
PEM Tropics B; DC-8; FLIGHT 8



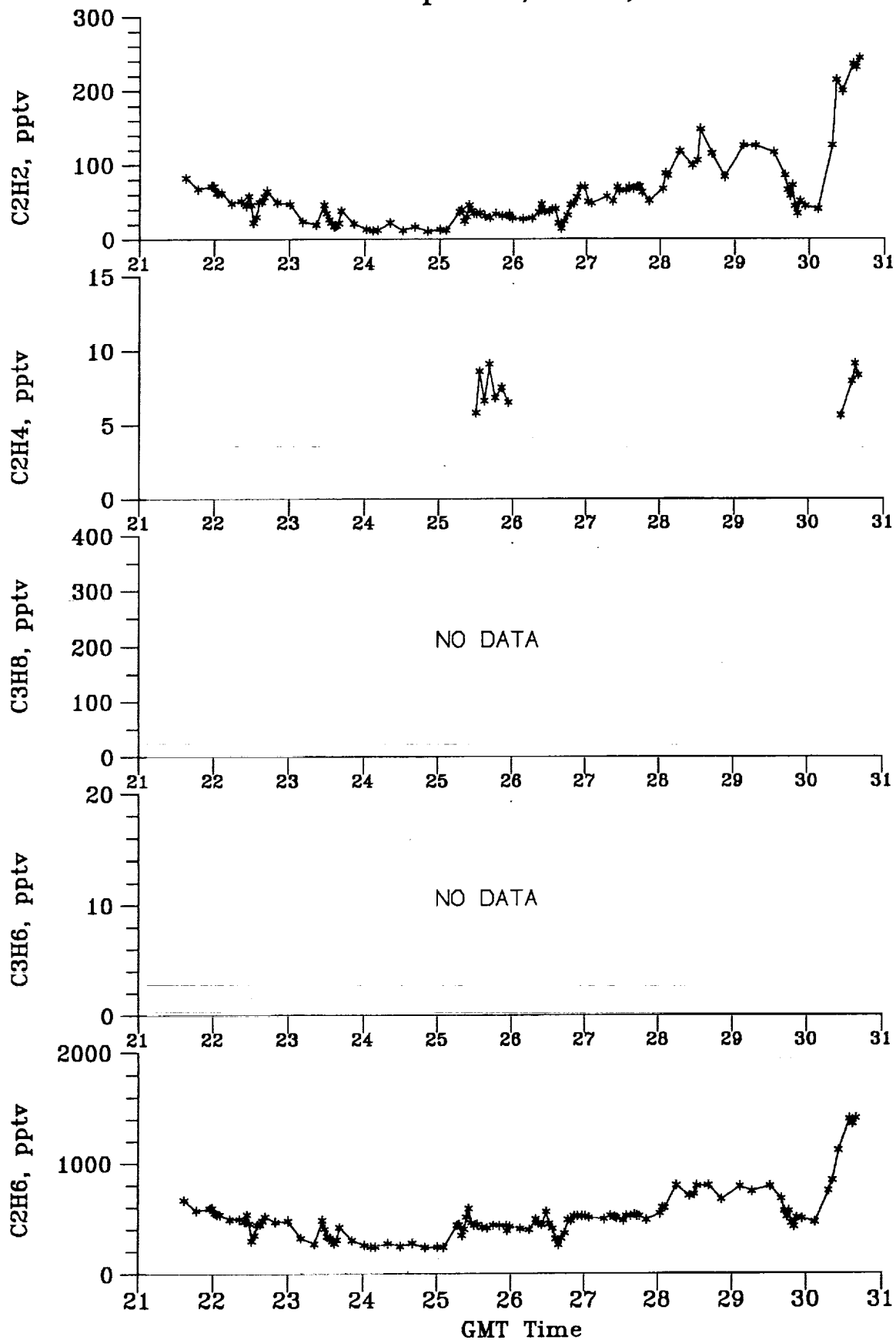
PEM Tropics B; DC-8; FLIGHT 8



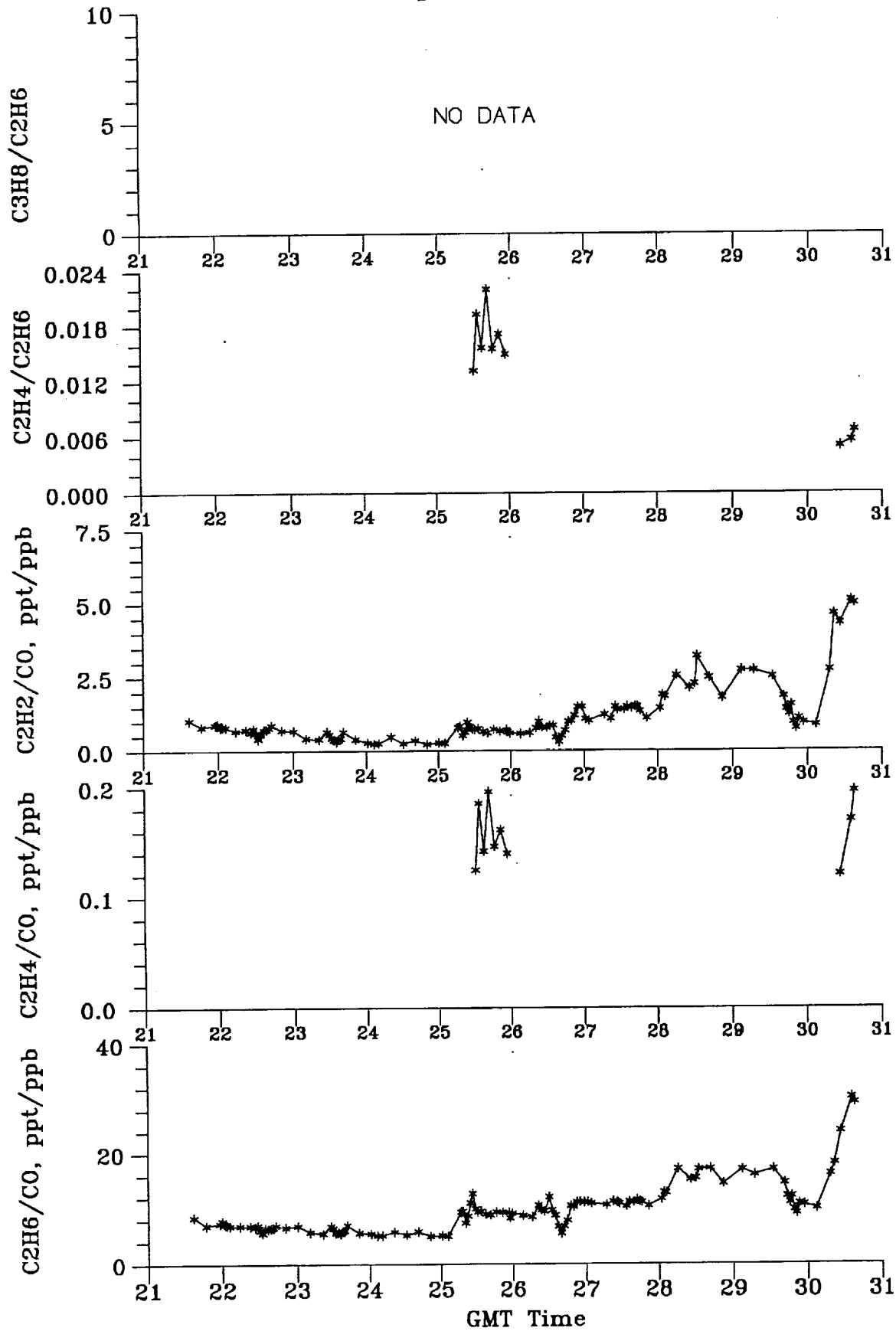
PEM Tropics B; DC-8; FLIGHT 8



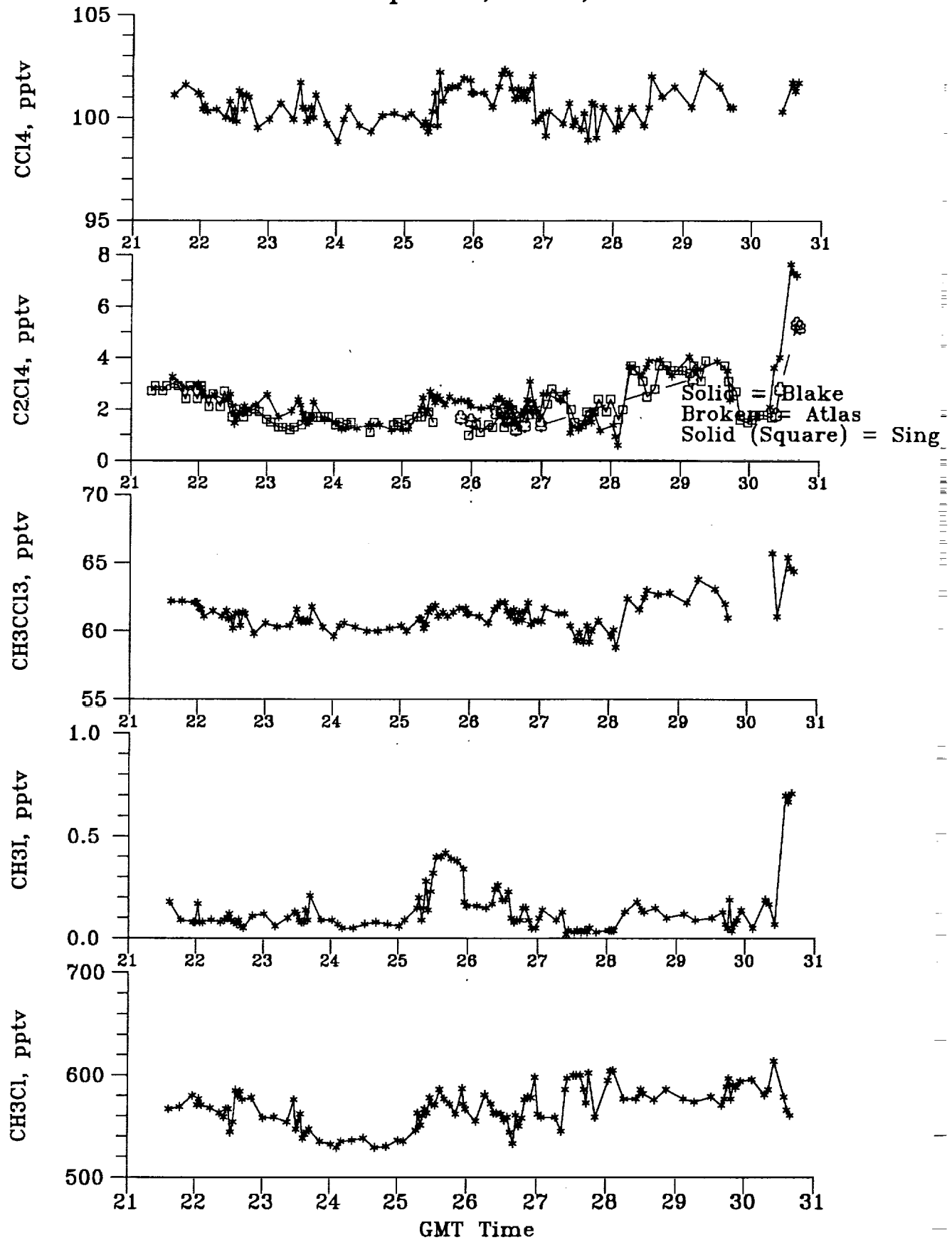
PEM Tropics B; DC-8; FLIGHT 8



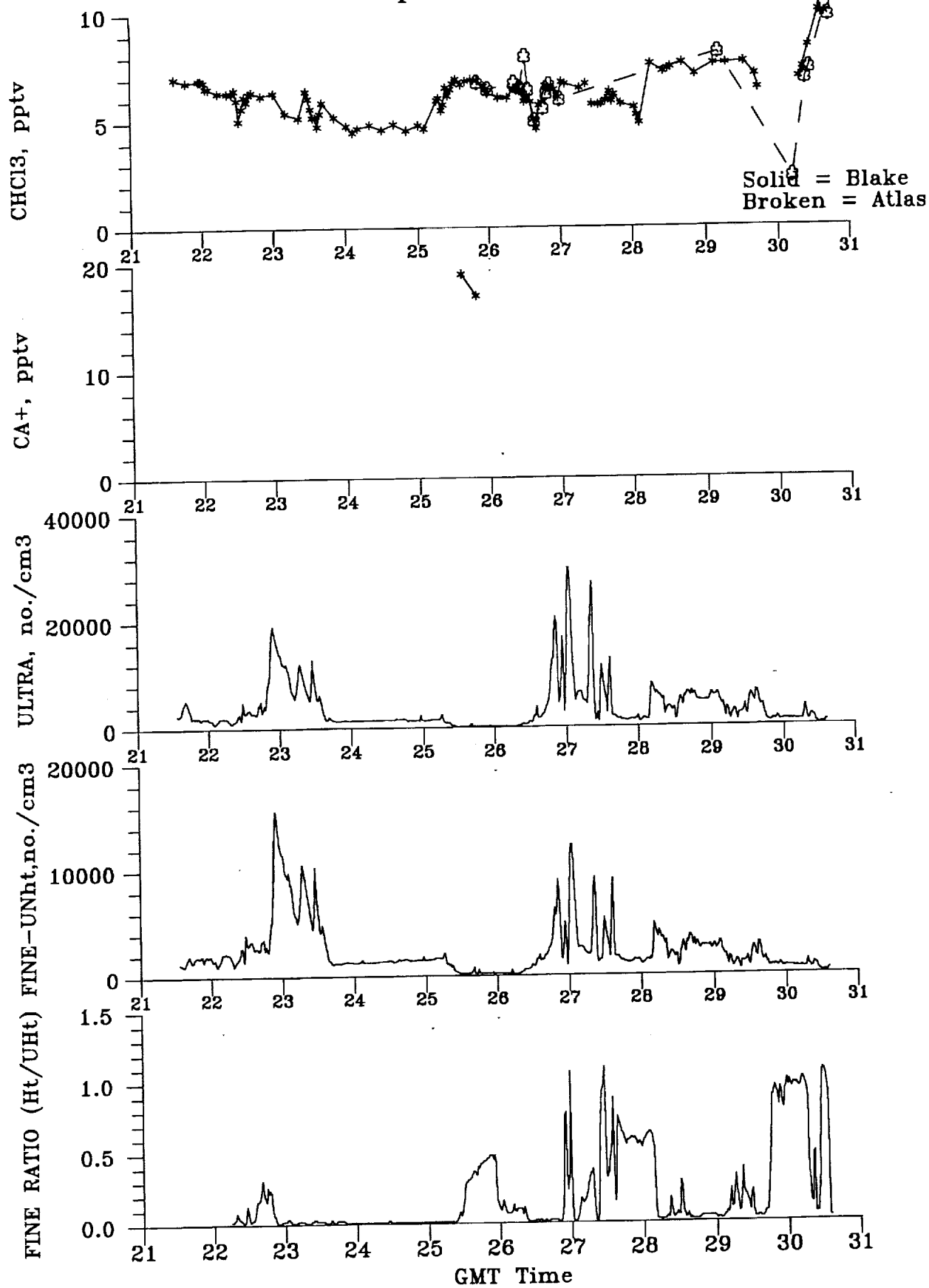
PEM Tropics B; DC-8; FLIGHT 8



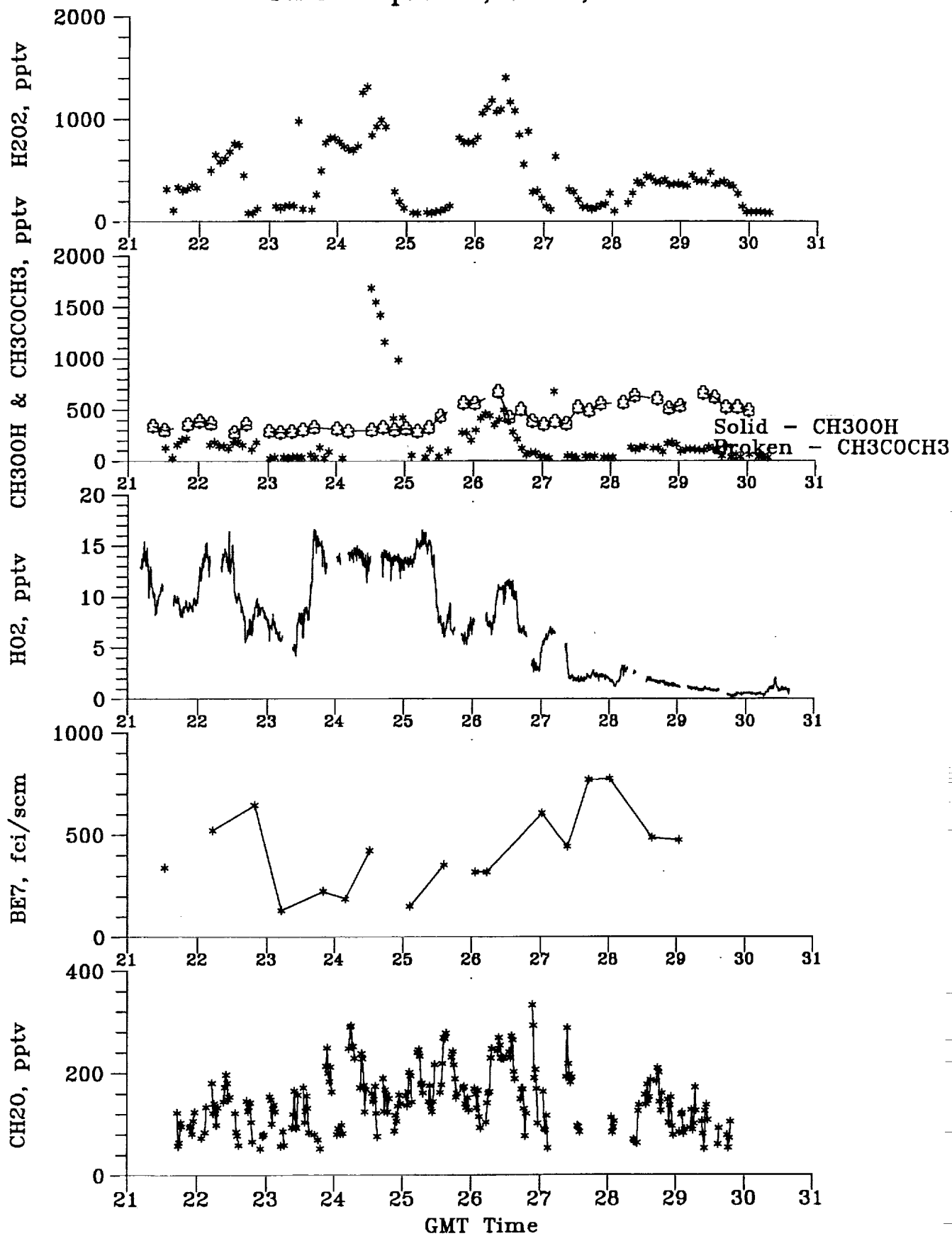
PEM Tropics B; DC-8; FLIGHT 8



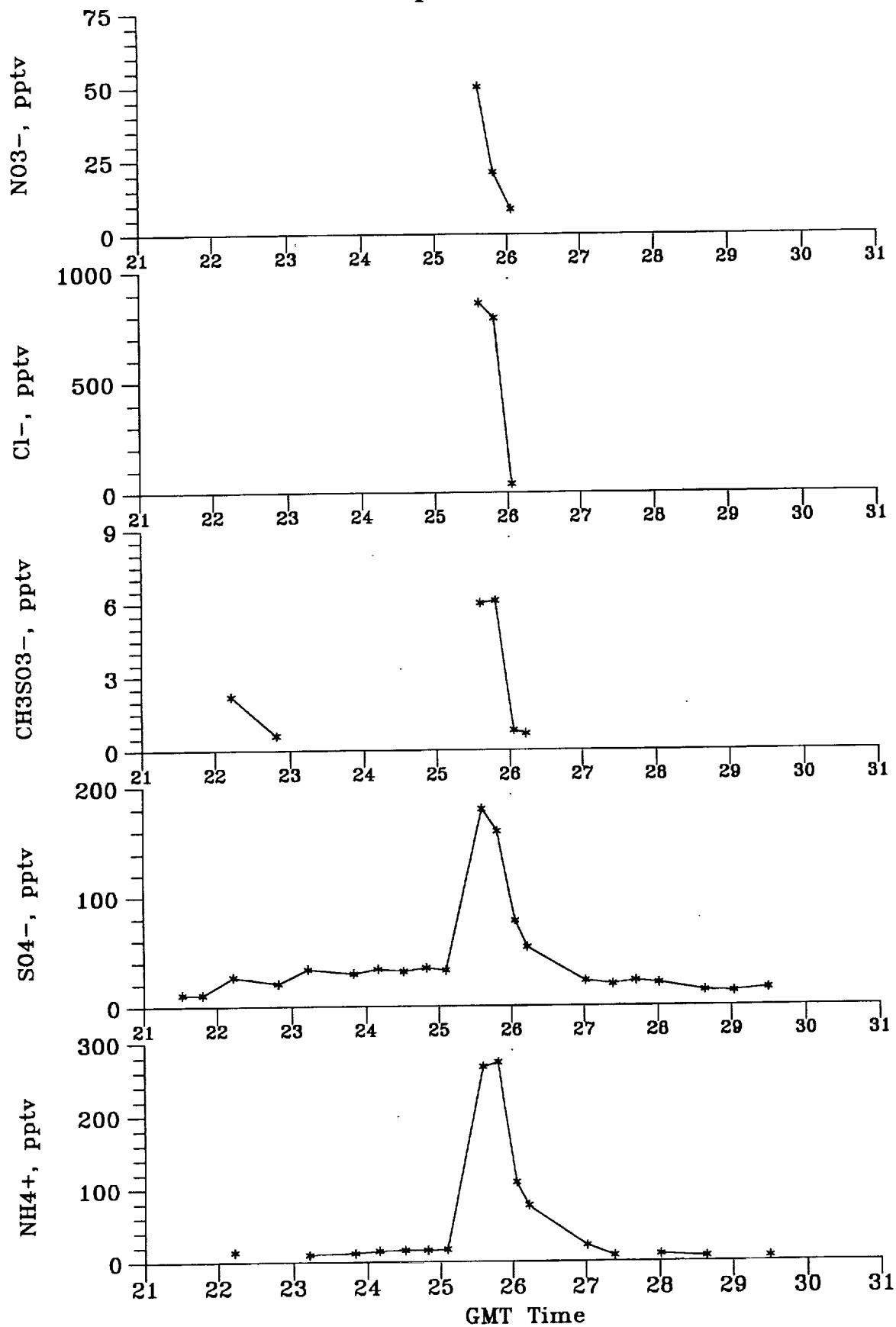
PEM Tropics B; DC-8; FLIGHT 8



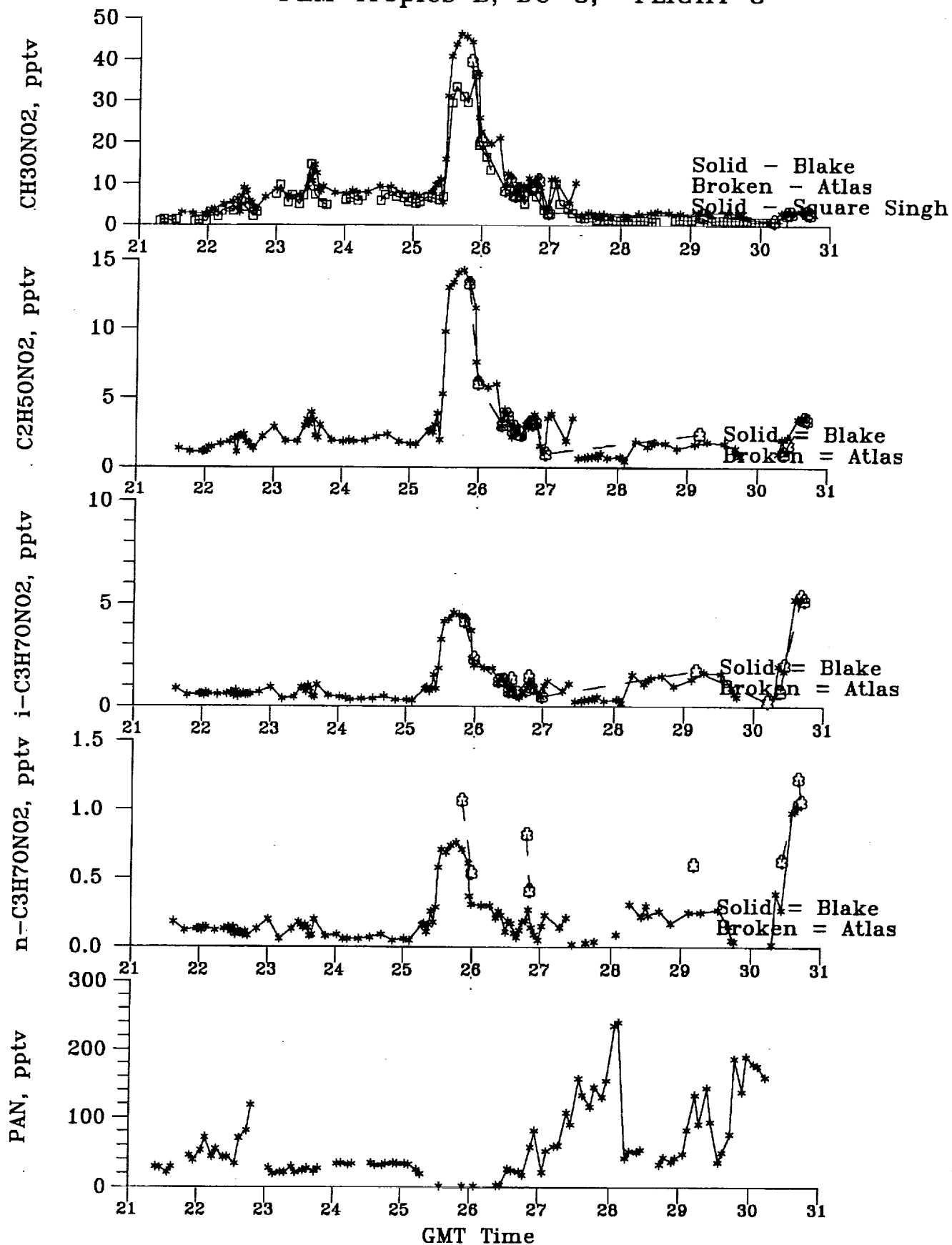
PEM Tropics B; DC-8; FLIGHT 8



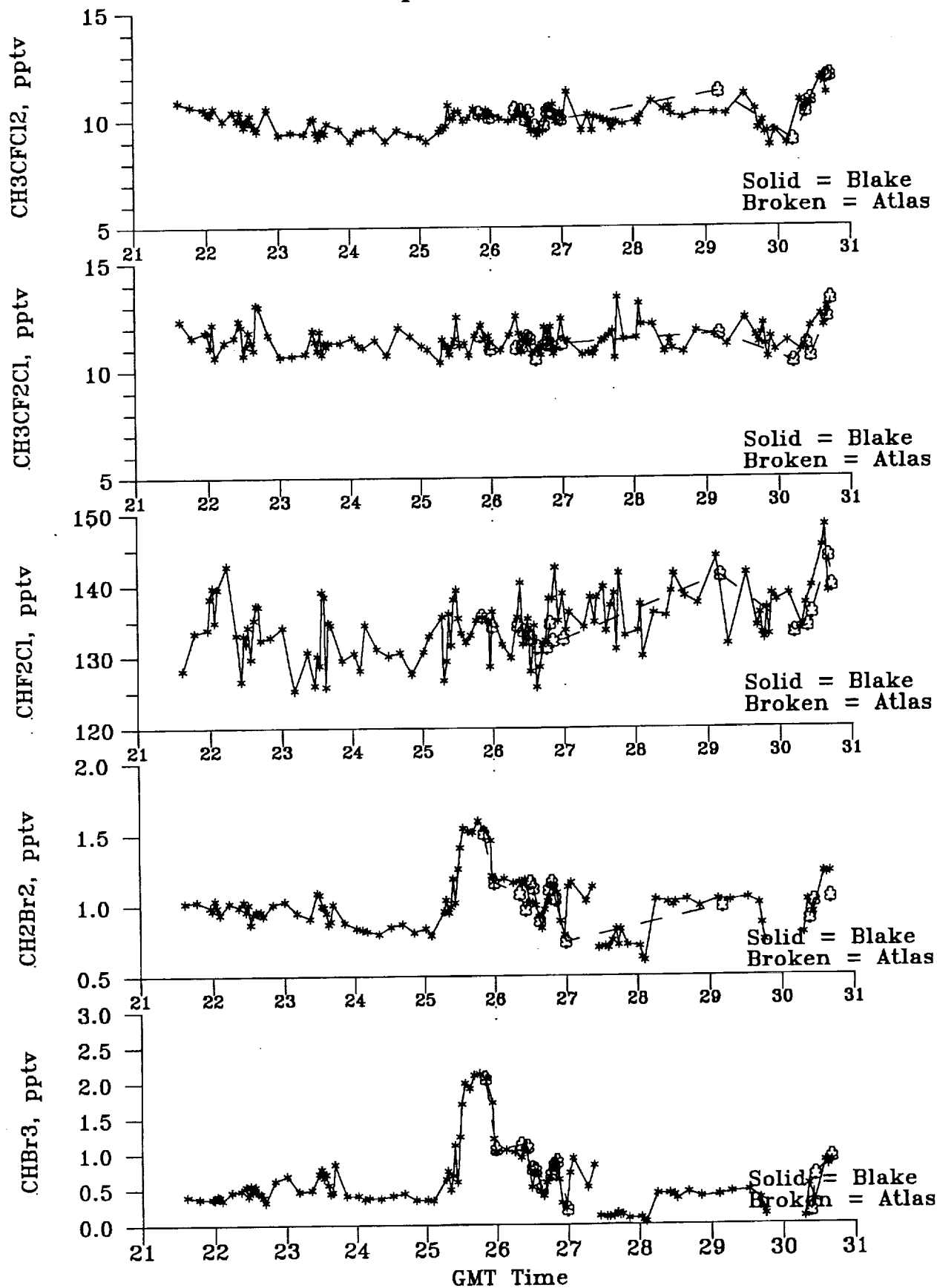
PEM Tropics B; DC-8; FLIGHT 8



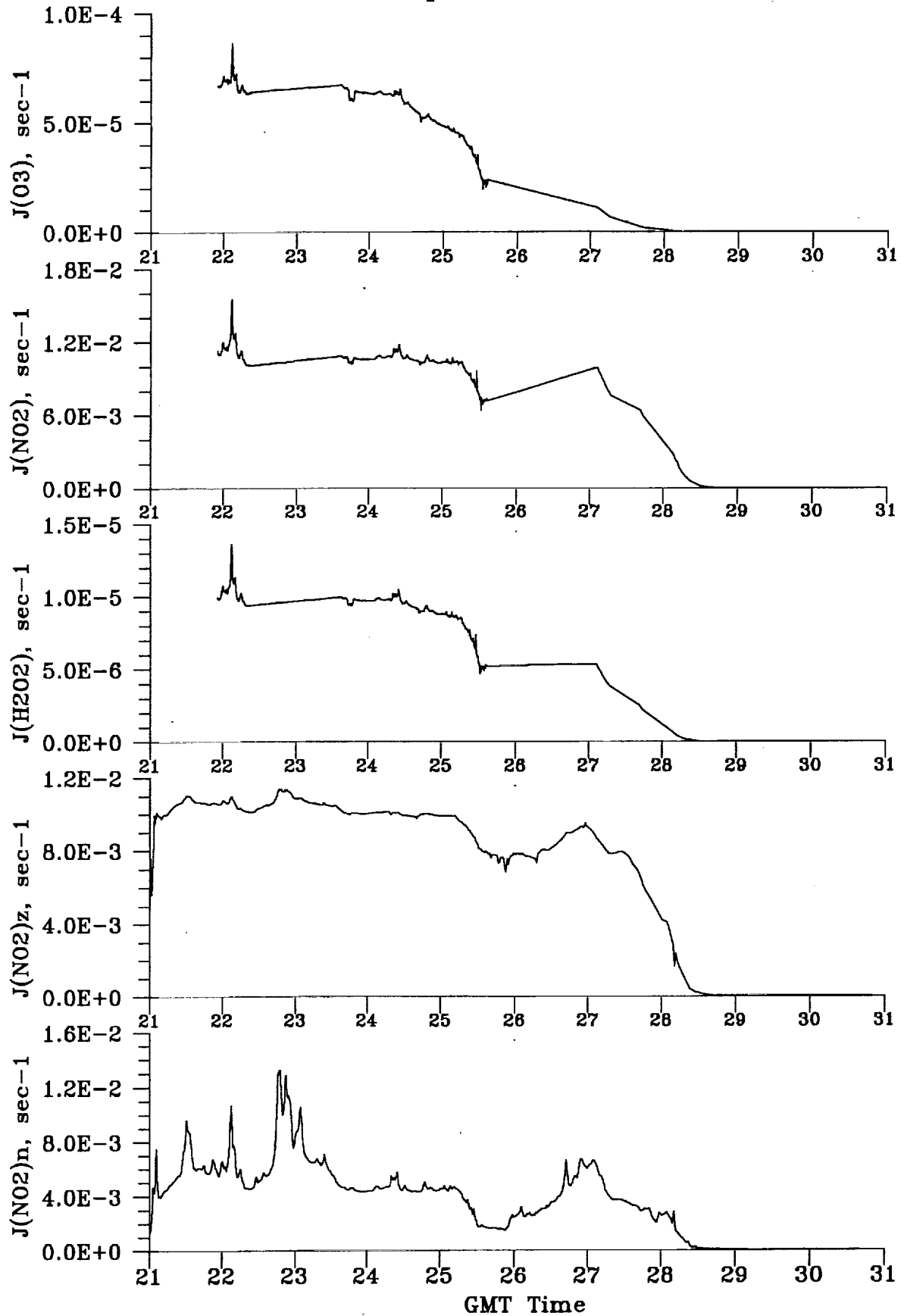
PEM Tropics B; DC-8; FLIGHT 8



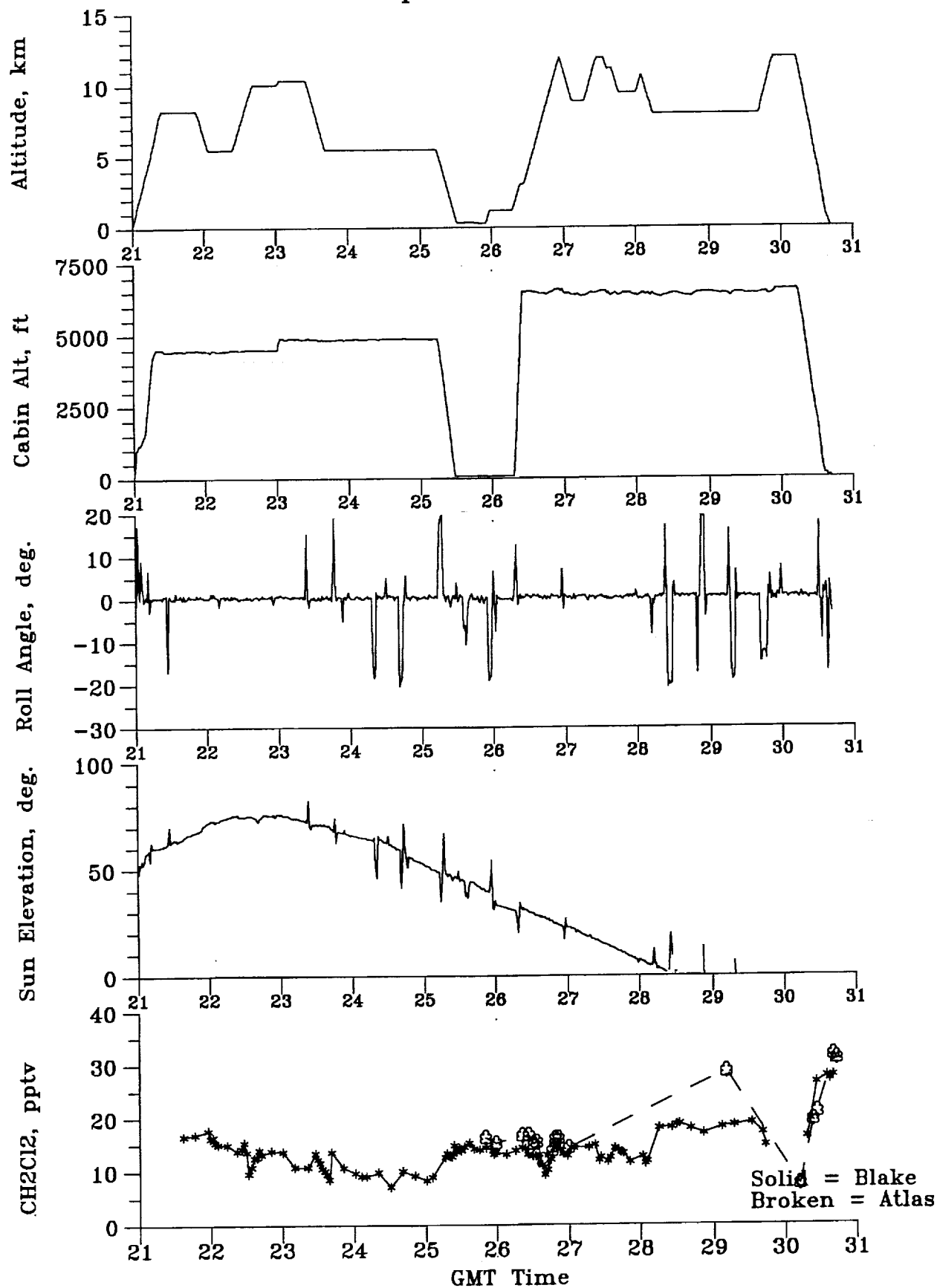
PEM Tropics B; DC-8; FLIGHT 8



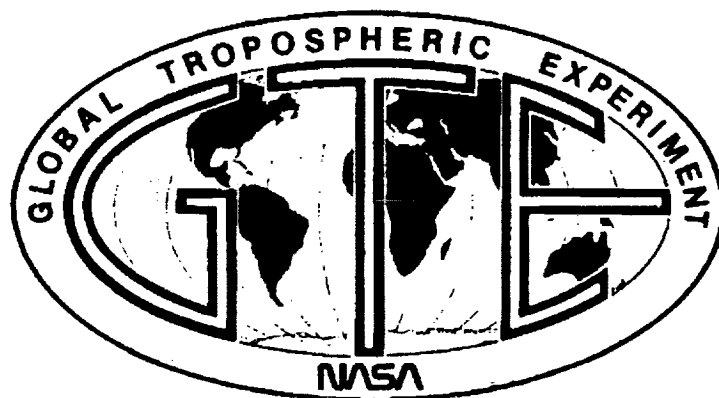
PEM Tropics B; DC-8; FLIGHT 8



PEM Tropics B; DC-8; FLIGHT 8



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

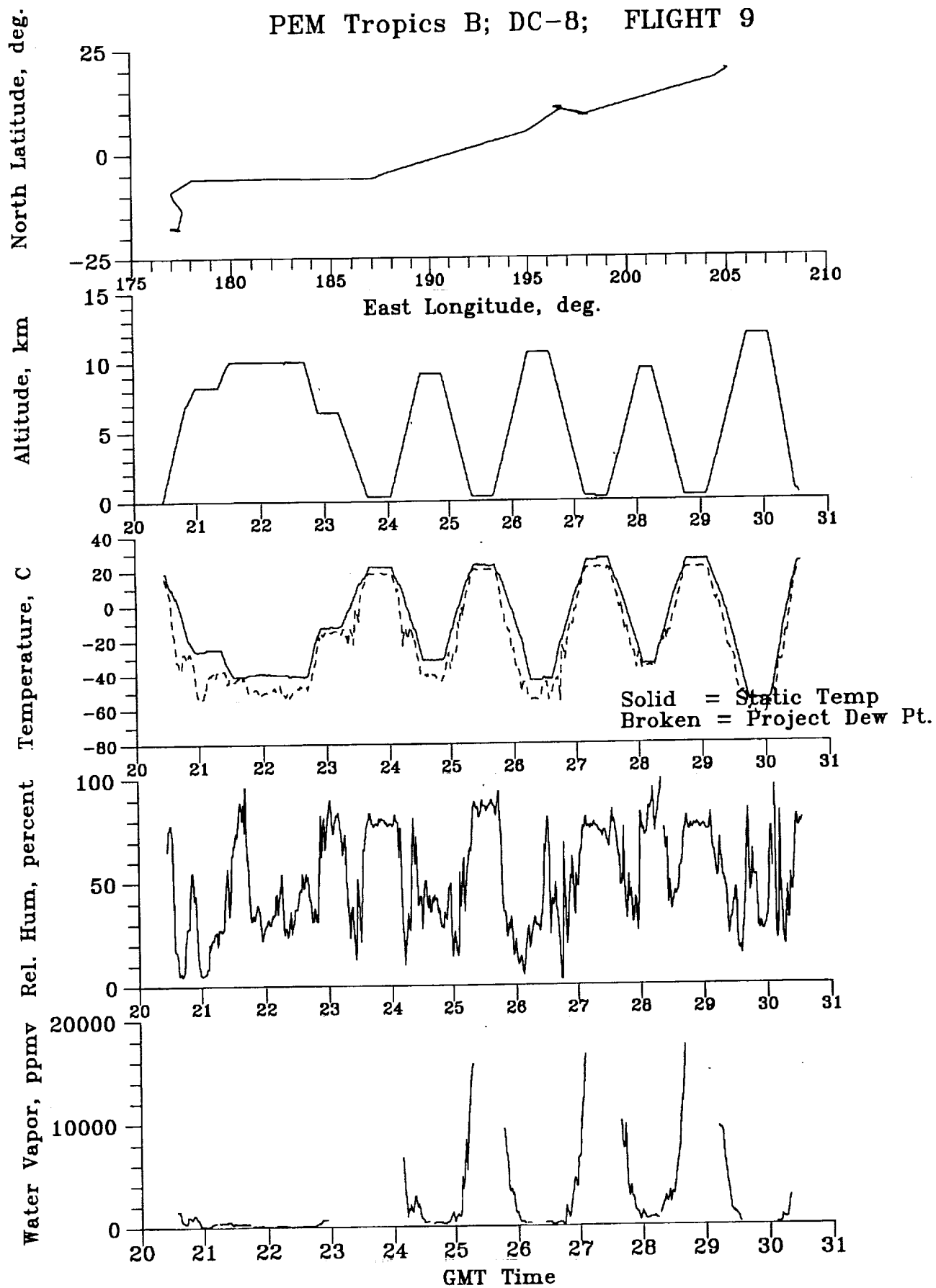
Flight 9D

Transit: Hilo to Fiji

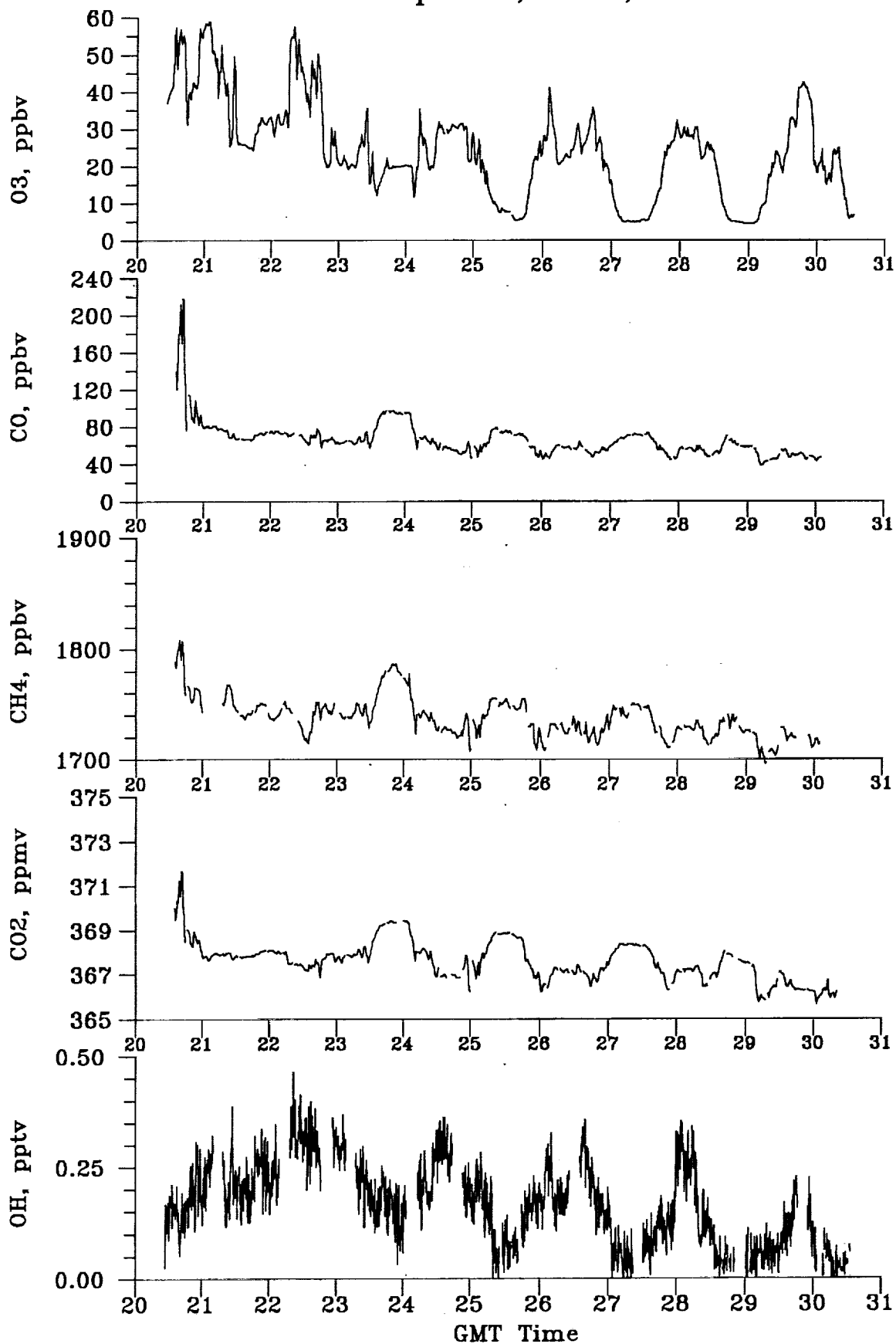
Equatorial Photochemistry

March 17, 1999

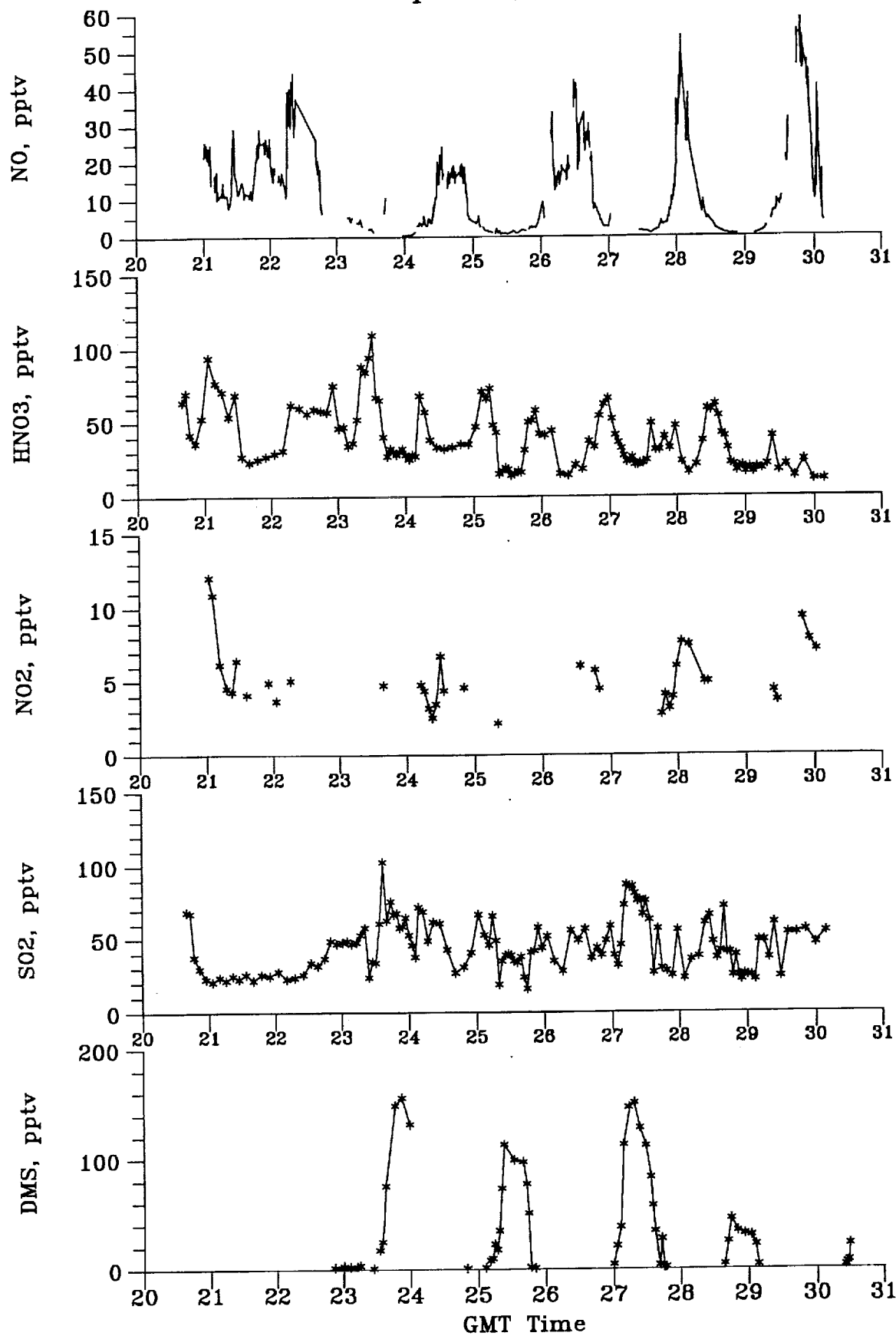
PEM Tropics B; DC-8; FLIGHT 9



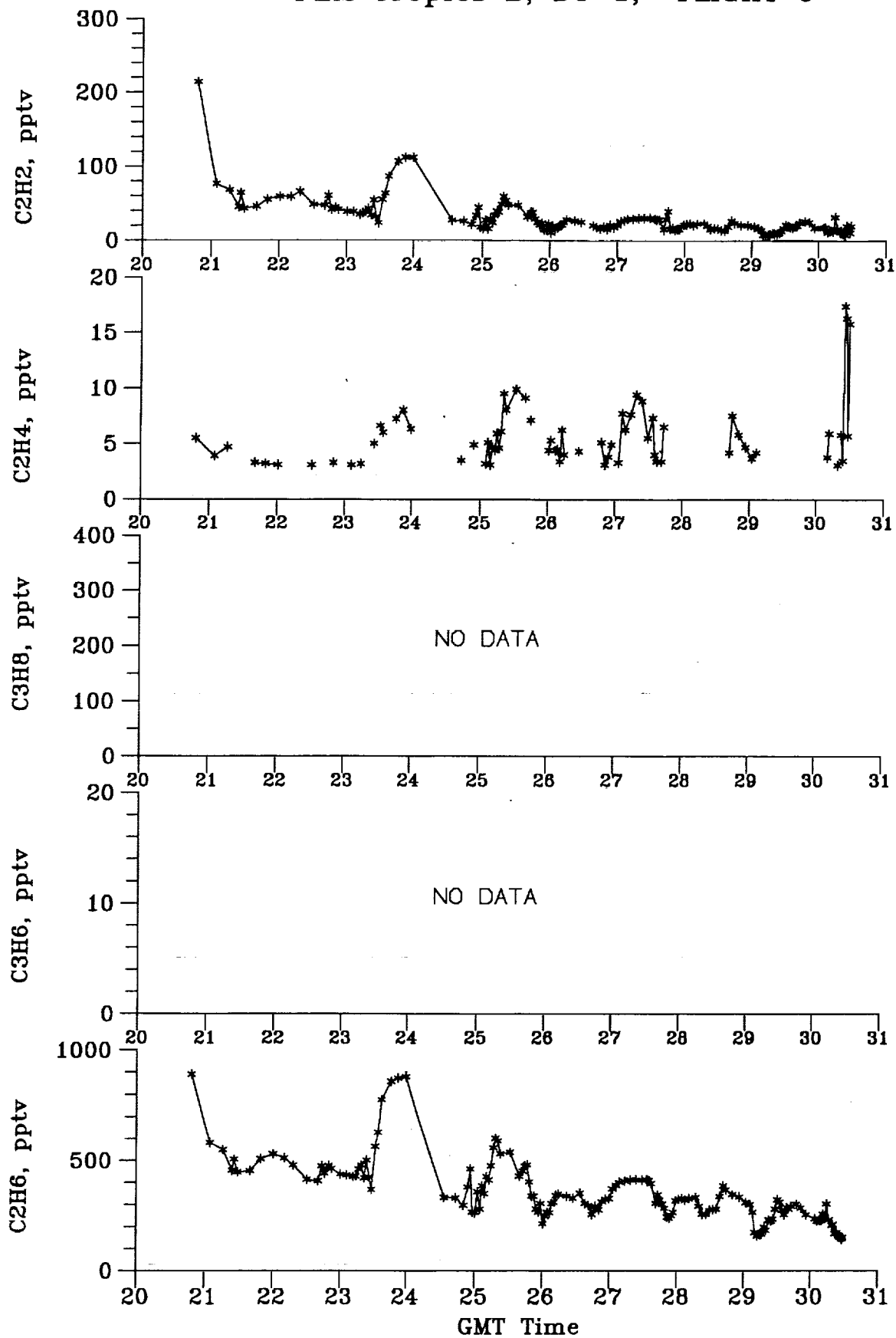
PEM Tropics B; DC-8; FLIGHT 9



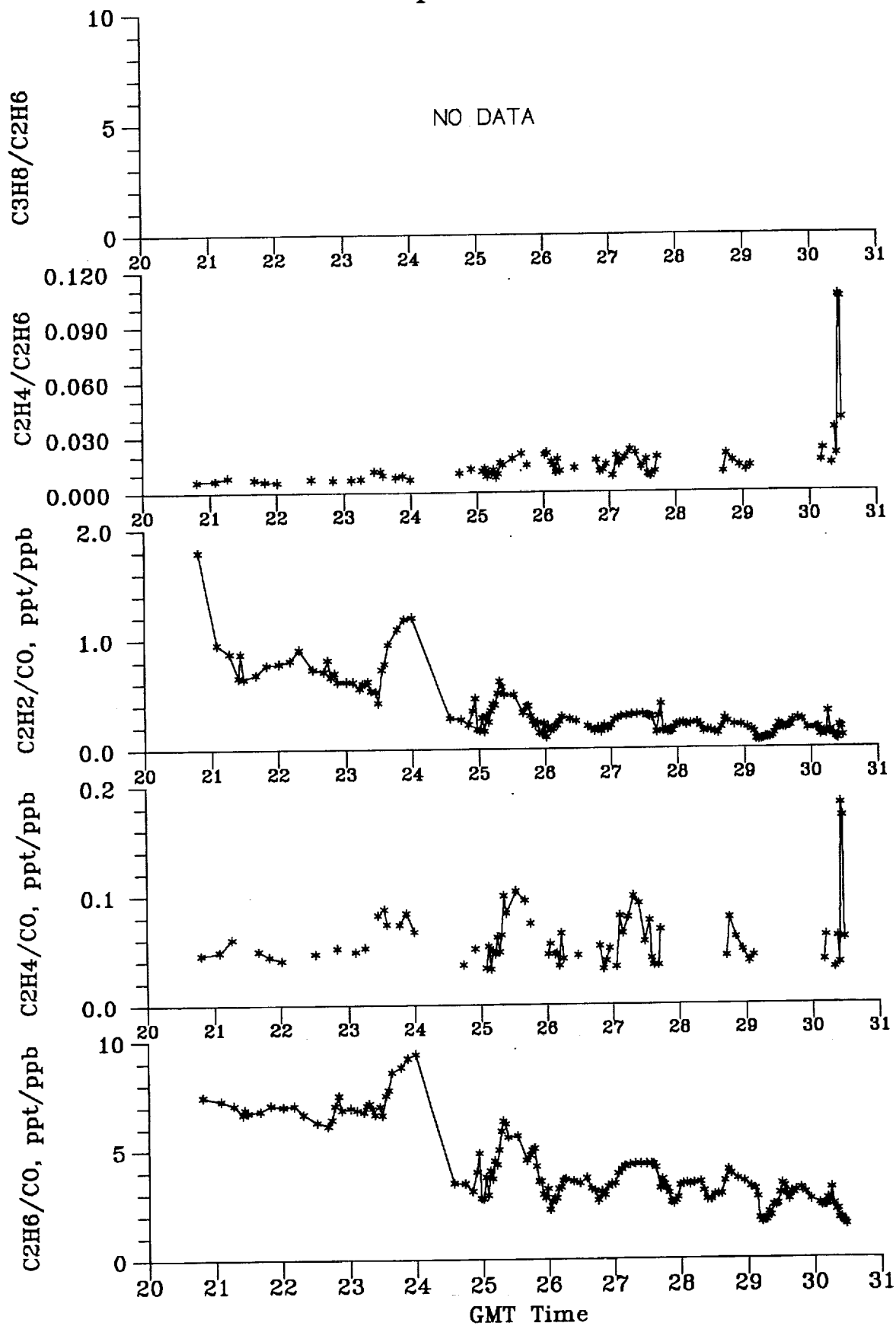
PEM Tropics B; DC-8; FLIGHT 9



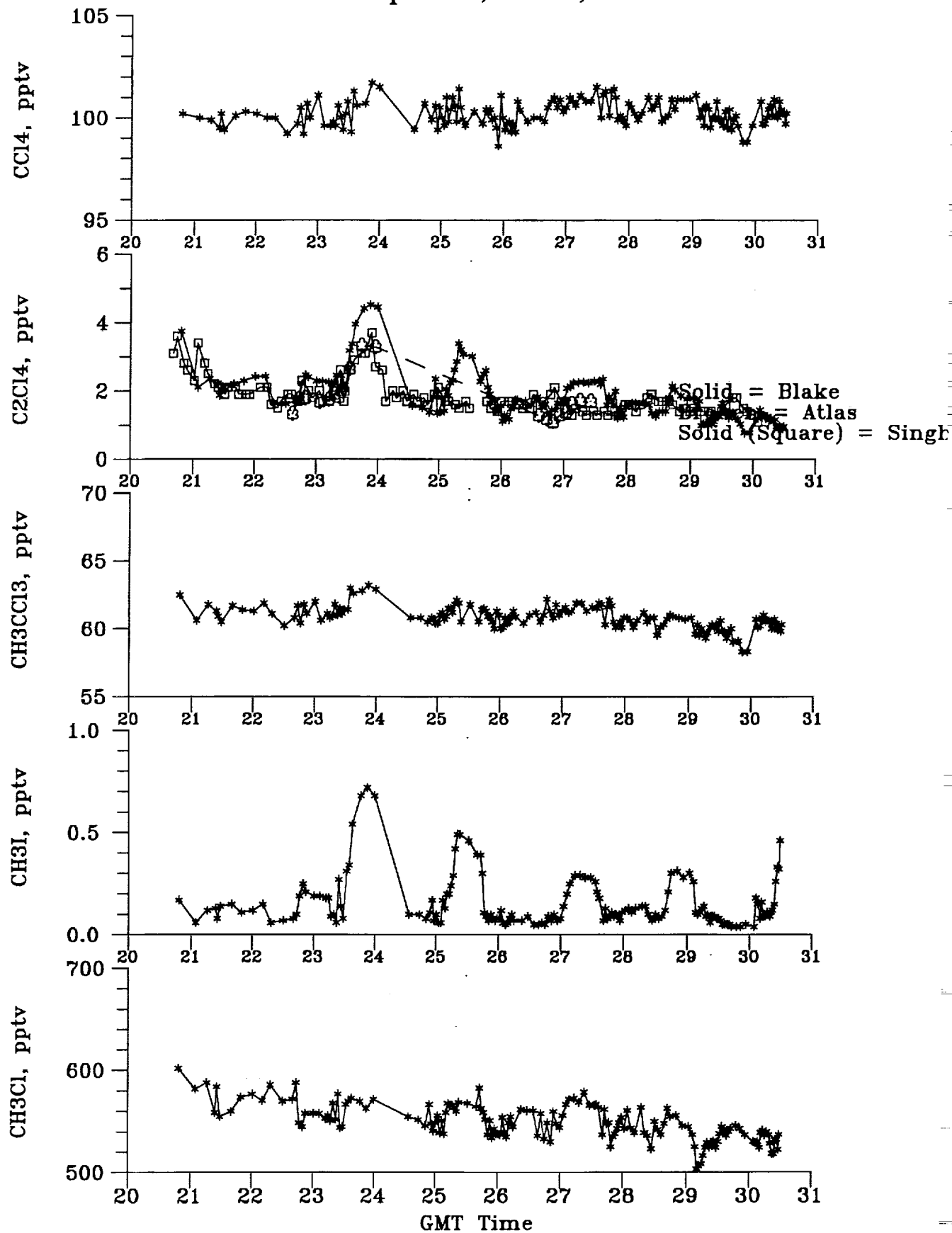
PEM Tropics B; DC-8; FLIGHT 9



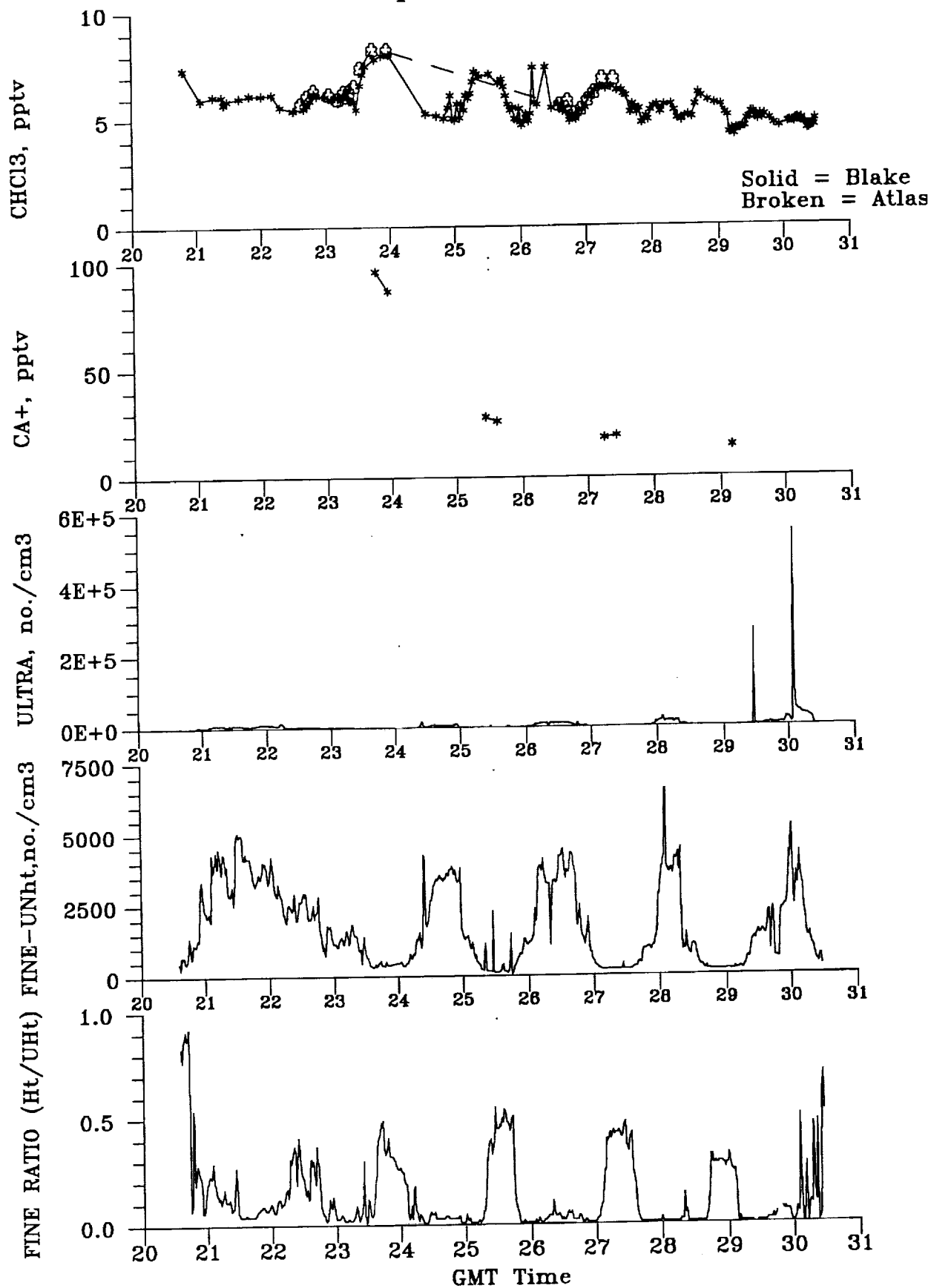
PEM Tropics B; DC-8; FLIGHT 9



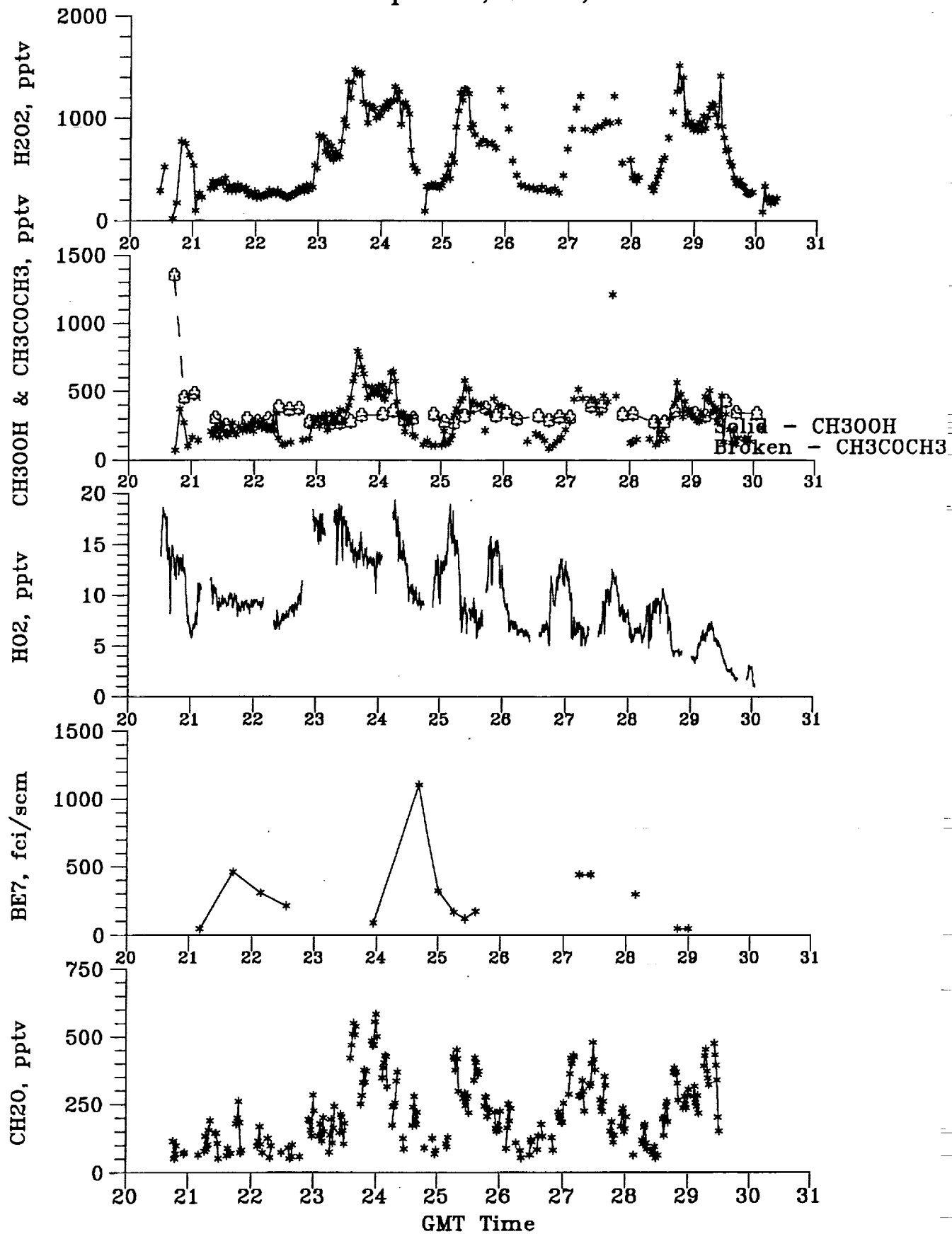
PEM Tropics B; DC-8; FLIGHT 9



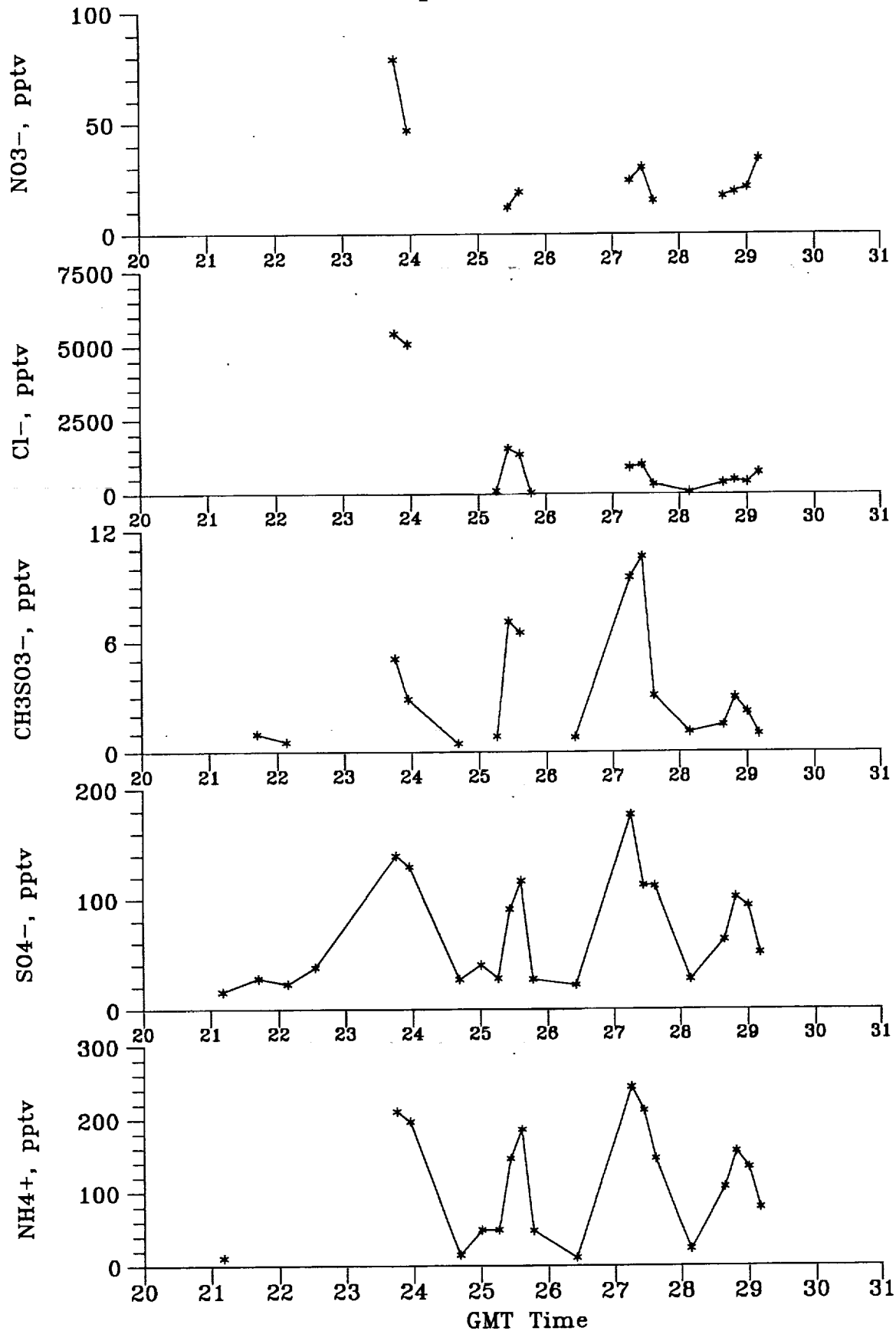
PEM Tropics B; DC-8; FLIGHT 9



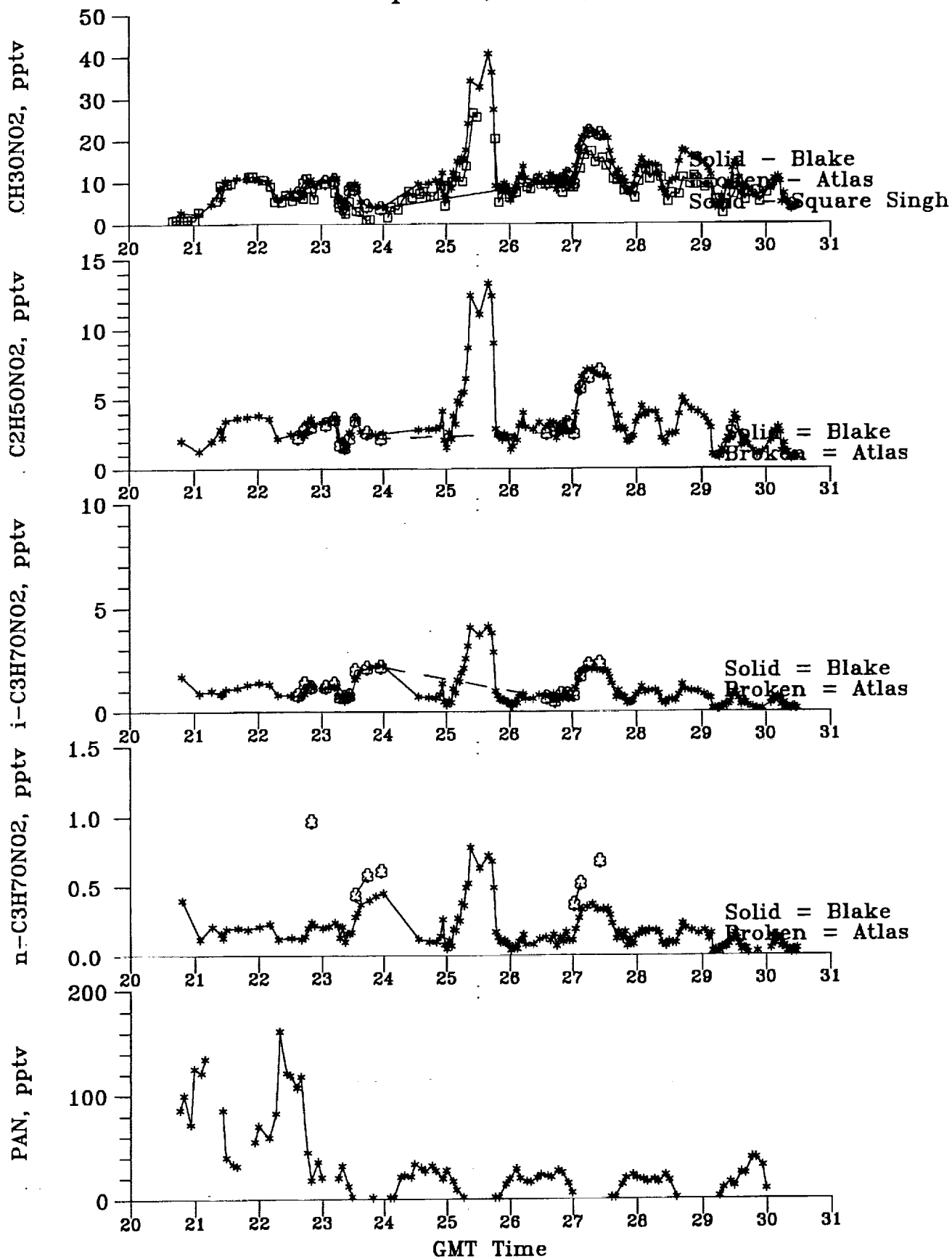
PEM Tropics B; DC-8; FLIGHT 9



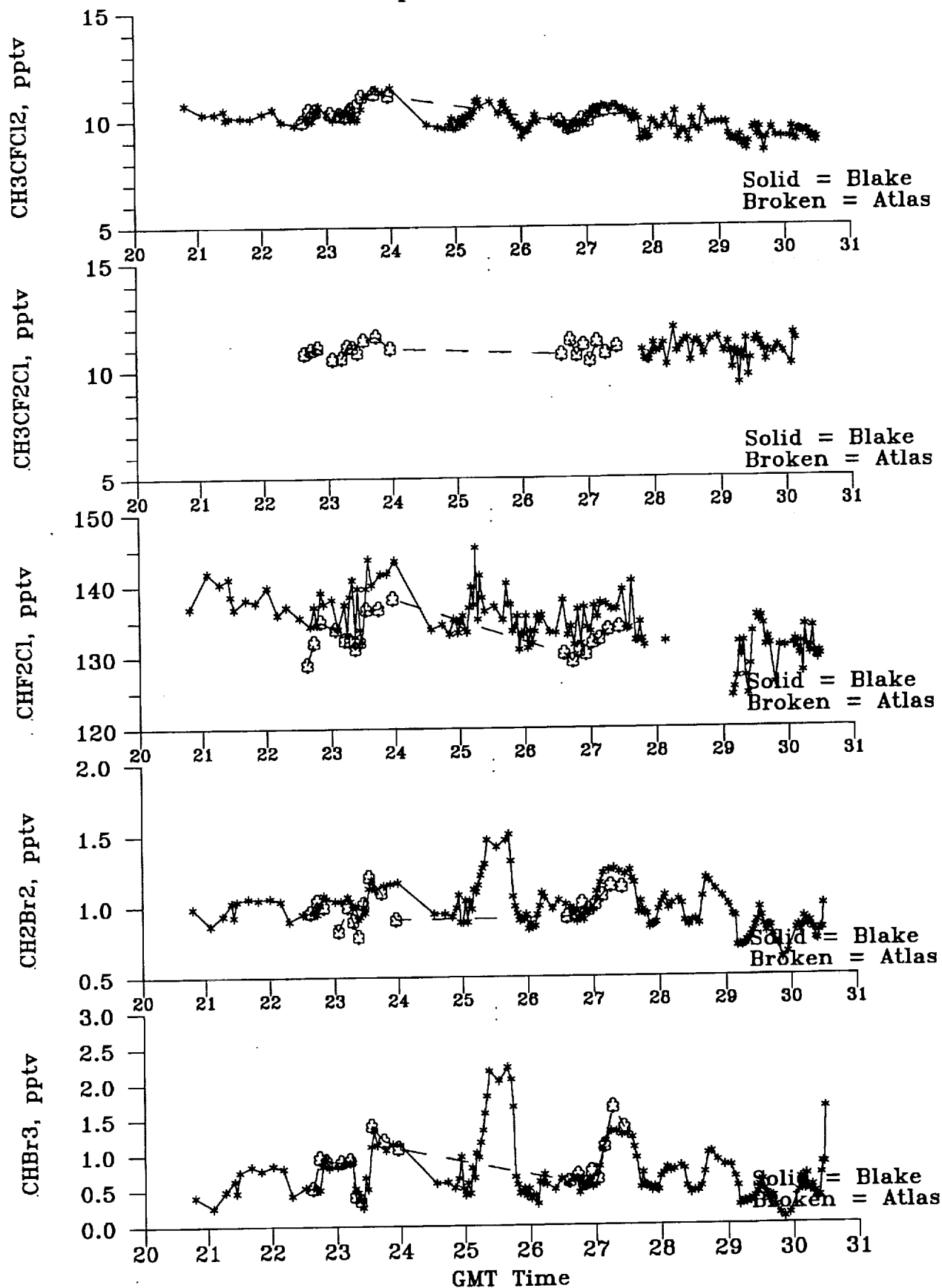
PEM Tropics B; DC-8; FLIGHT 9



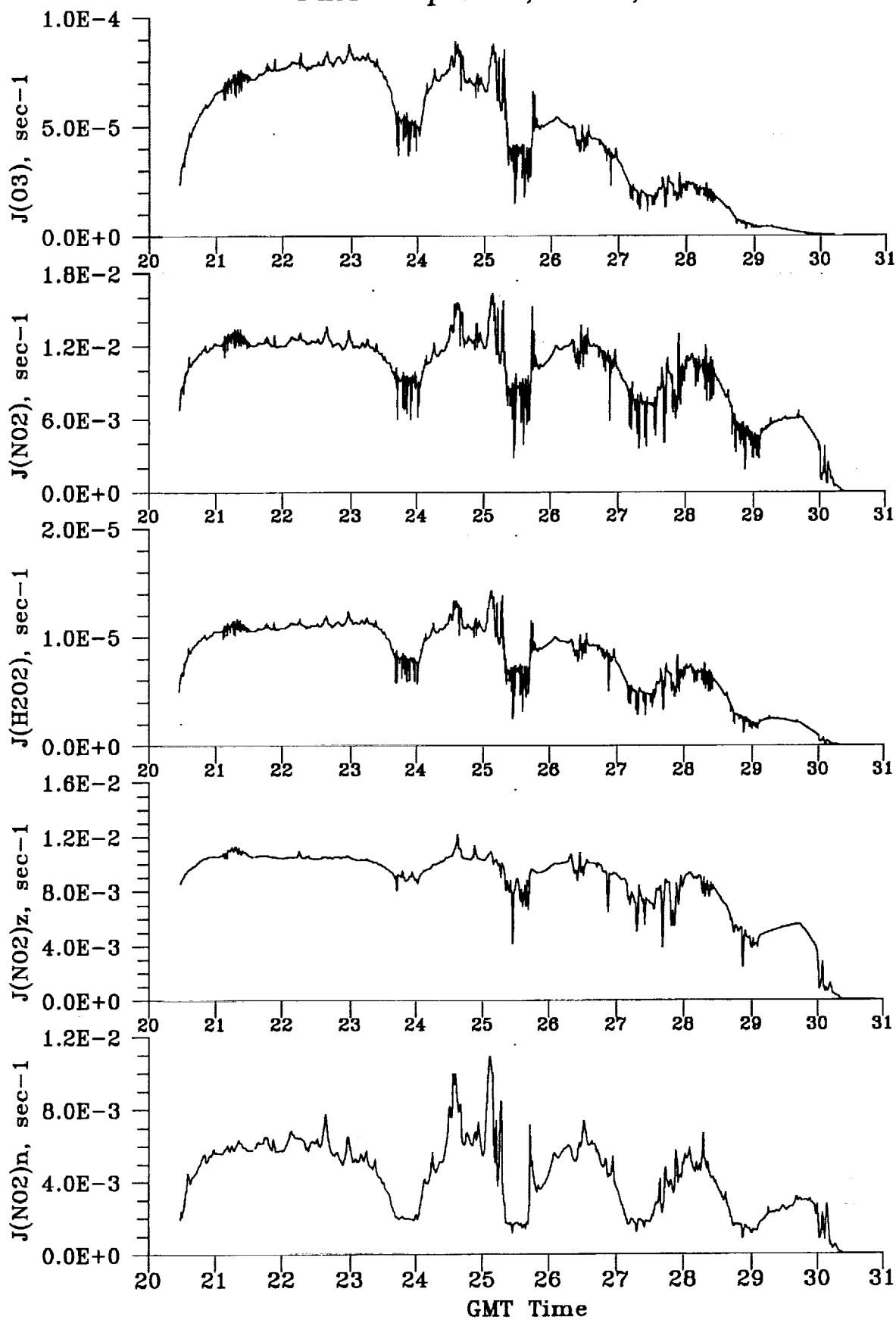
PEM Tropics B; DC-8; FLIGHT 9



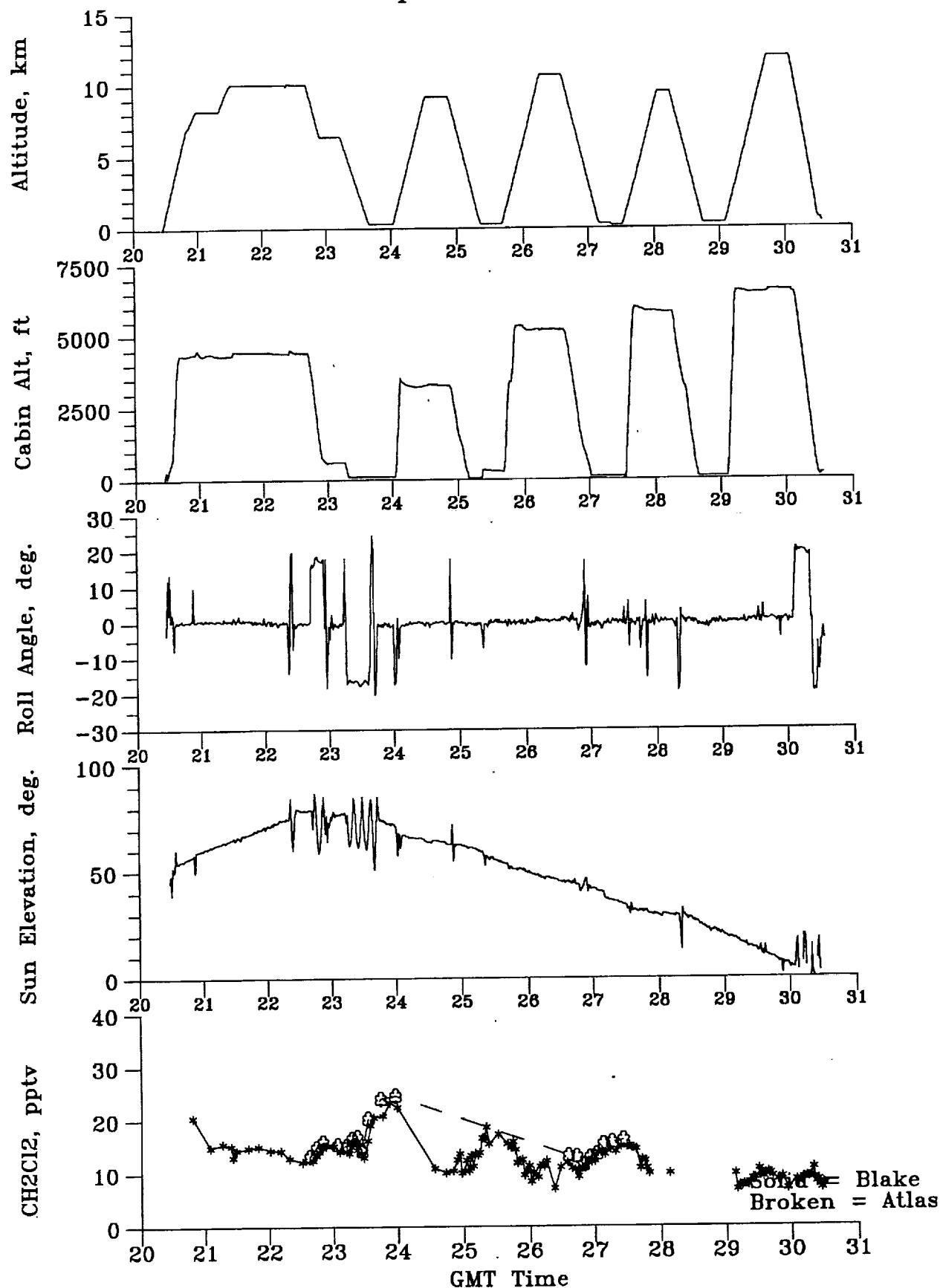
PEM Tropics B; DC-8; FLIGHT 9



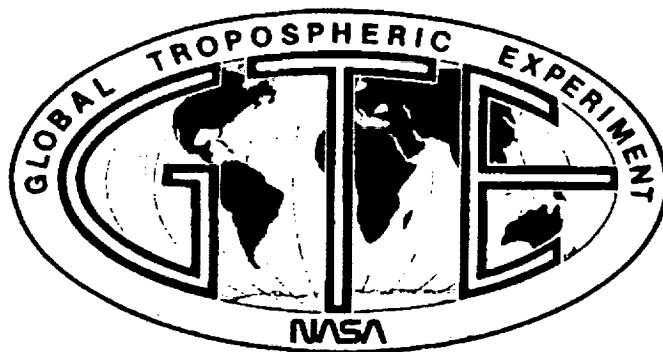
PEM Tropics B; DC-8; FLIGHT 9



PEM Tropics B; DC-8; FLIGHT 9



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

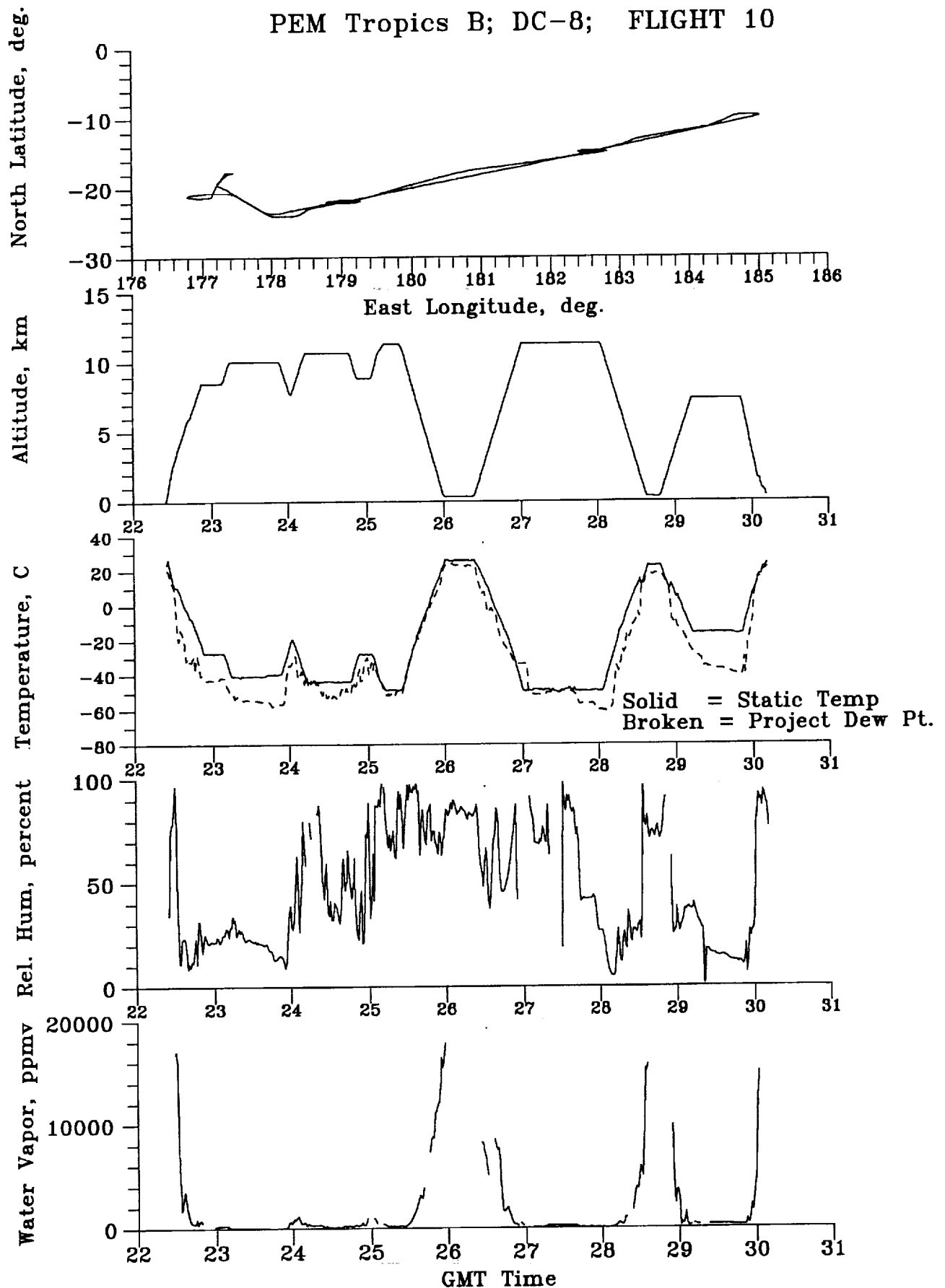
Flight 10D

Local: Fiji No. 1

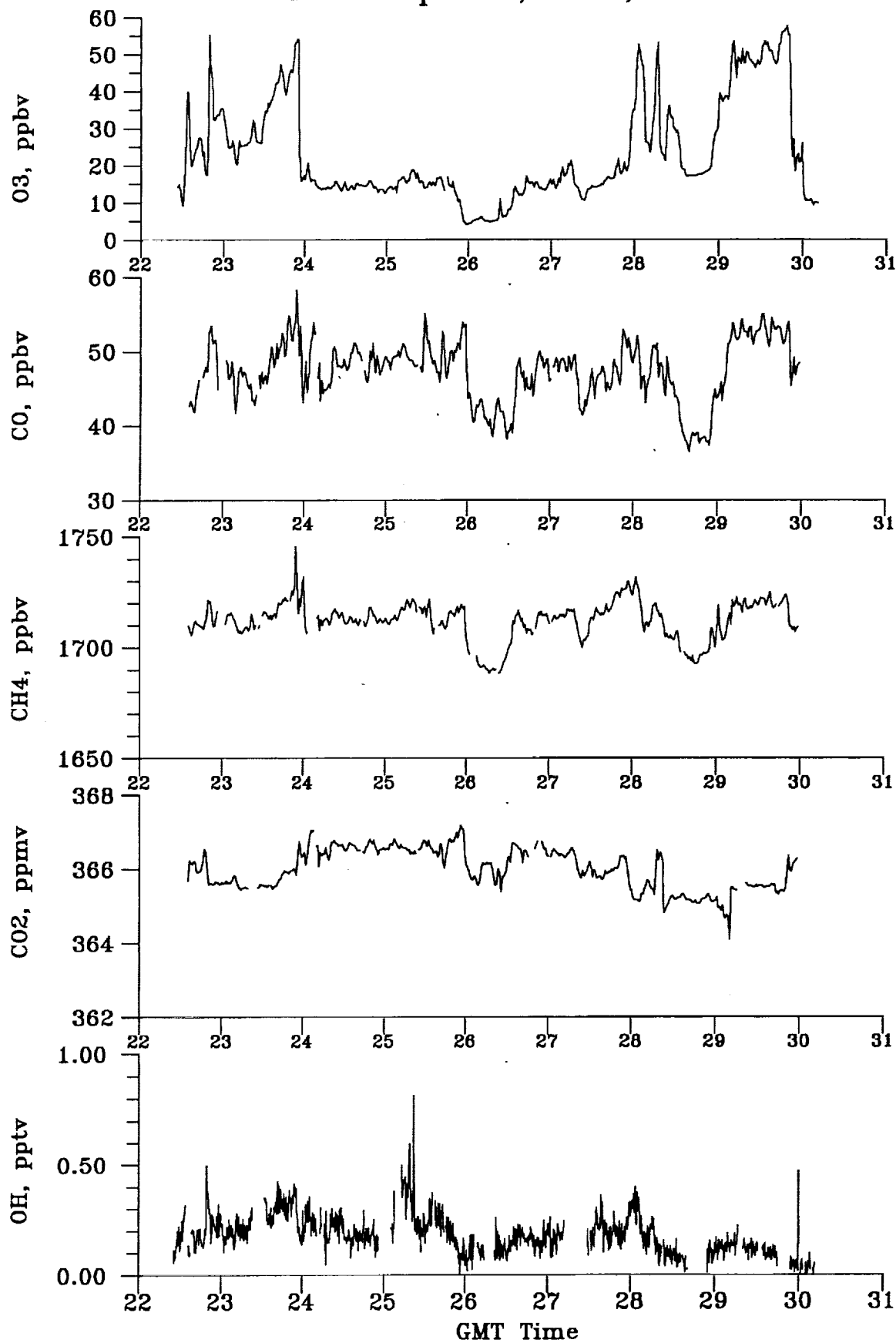
SPCZ

March 20, 1999

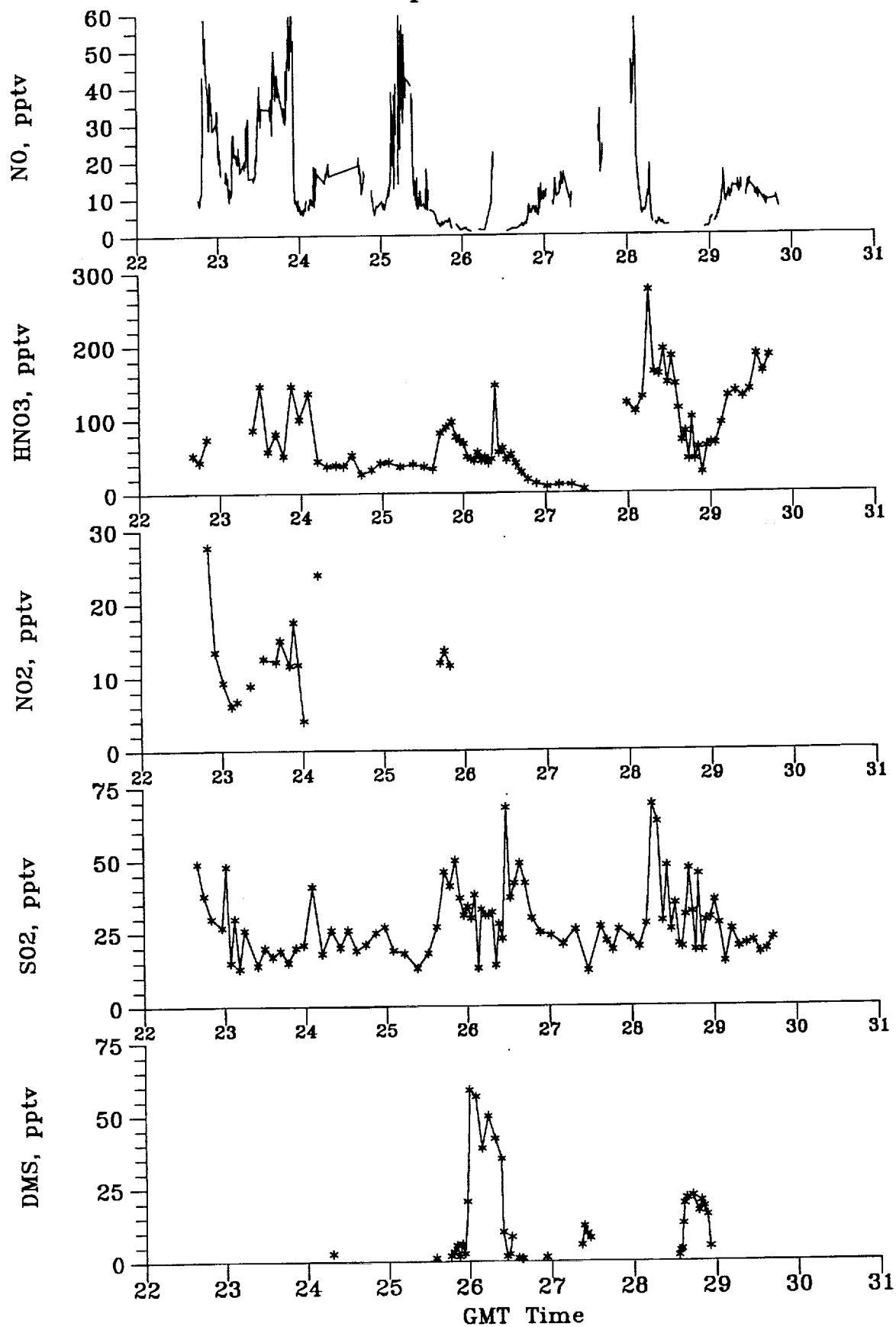
PEM Tropics B; DC-8; FLIGHT 10



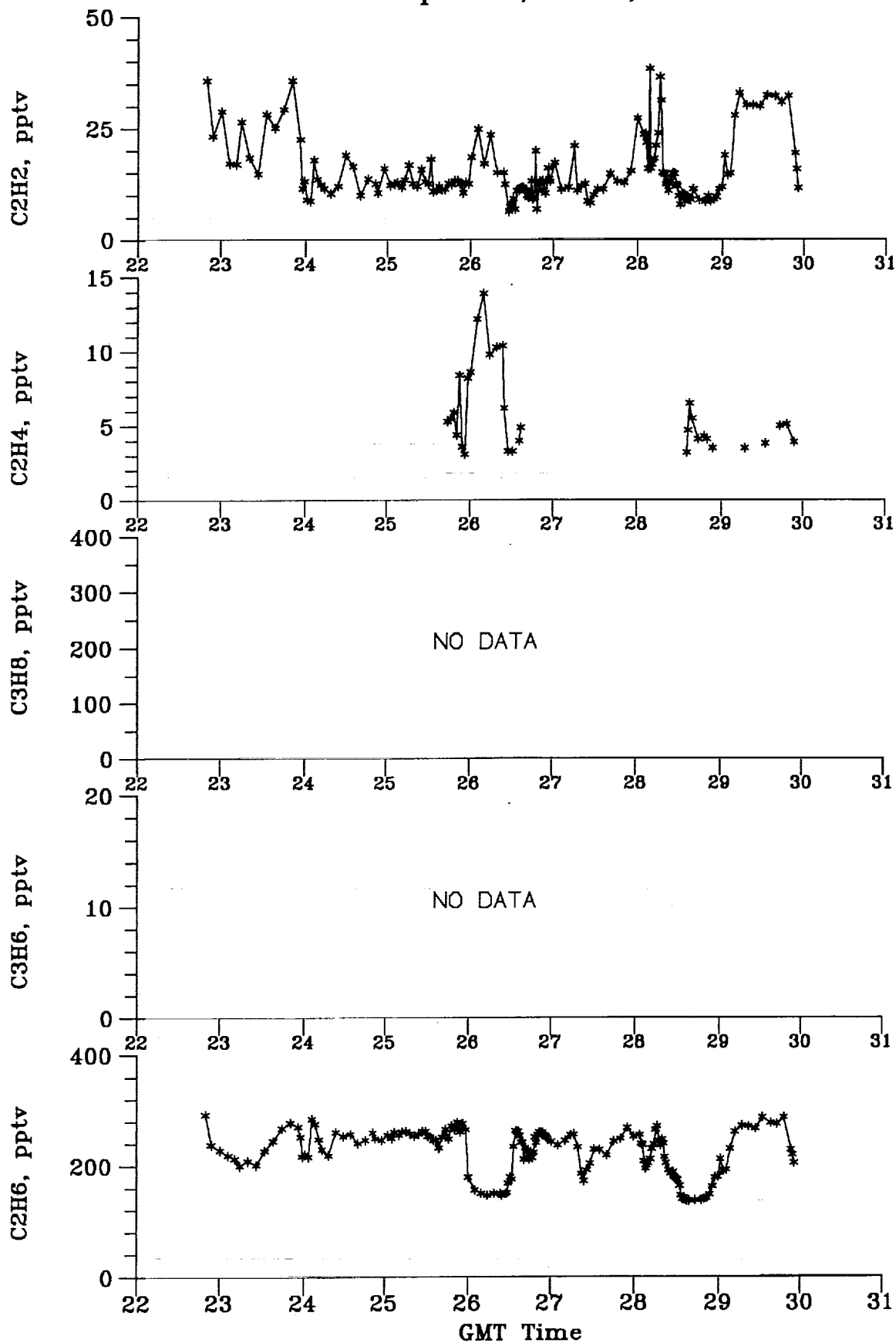
PEM Tropics B; DC-8; FLIGHT 10



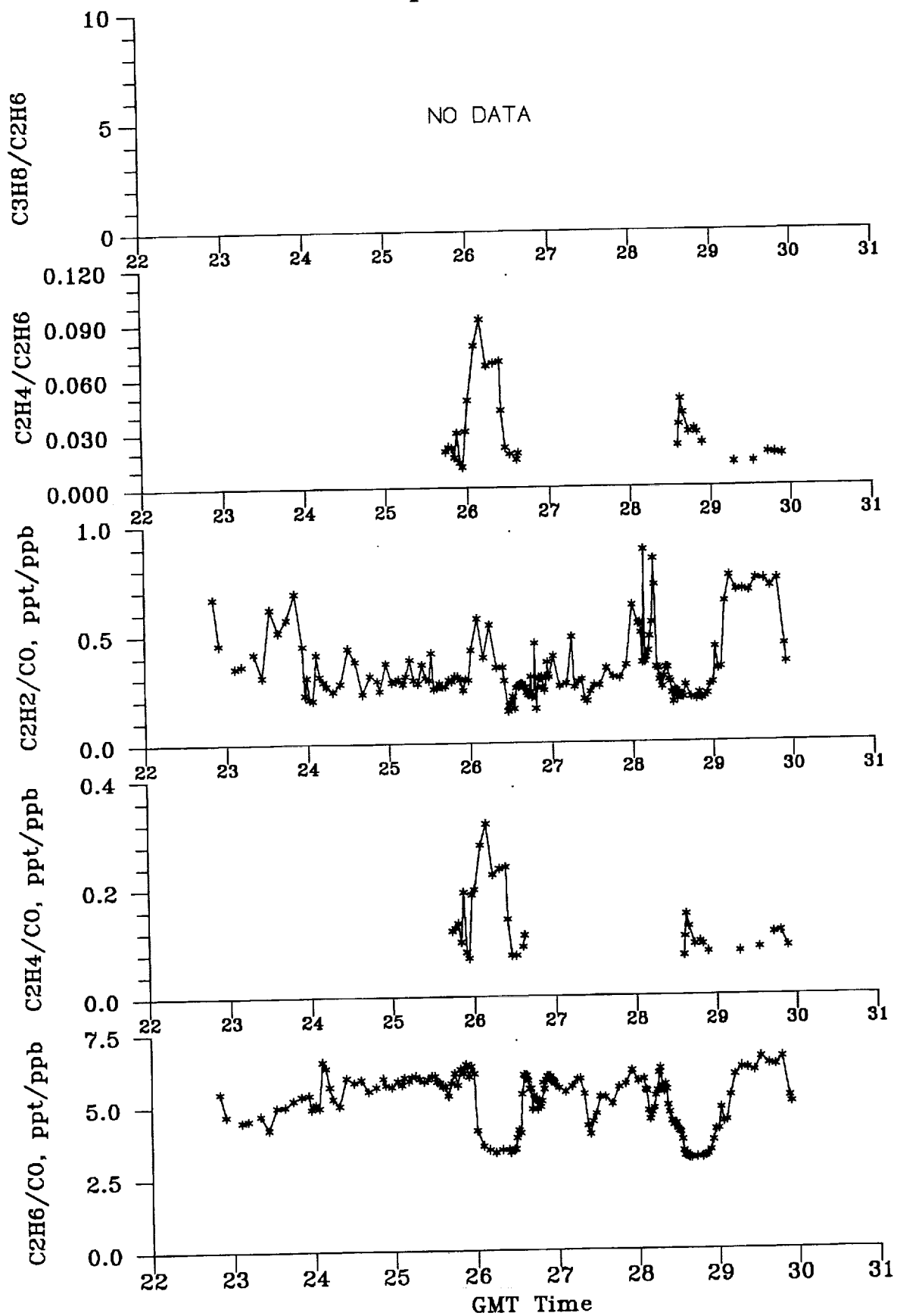
PEM Tropics B; DC-8; FLIGHT 10



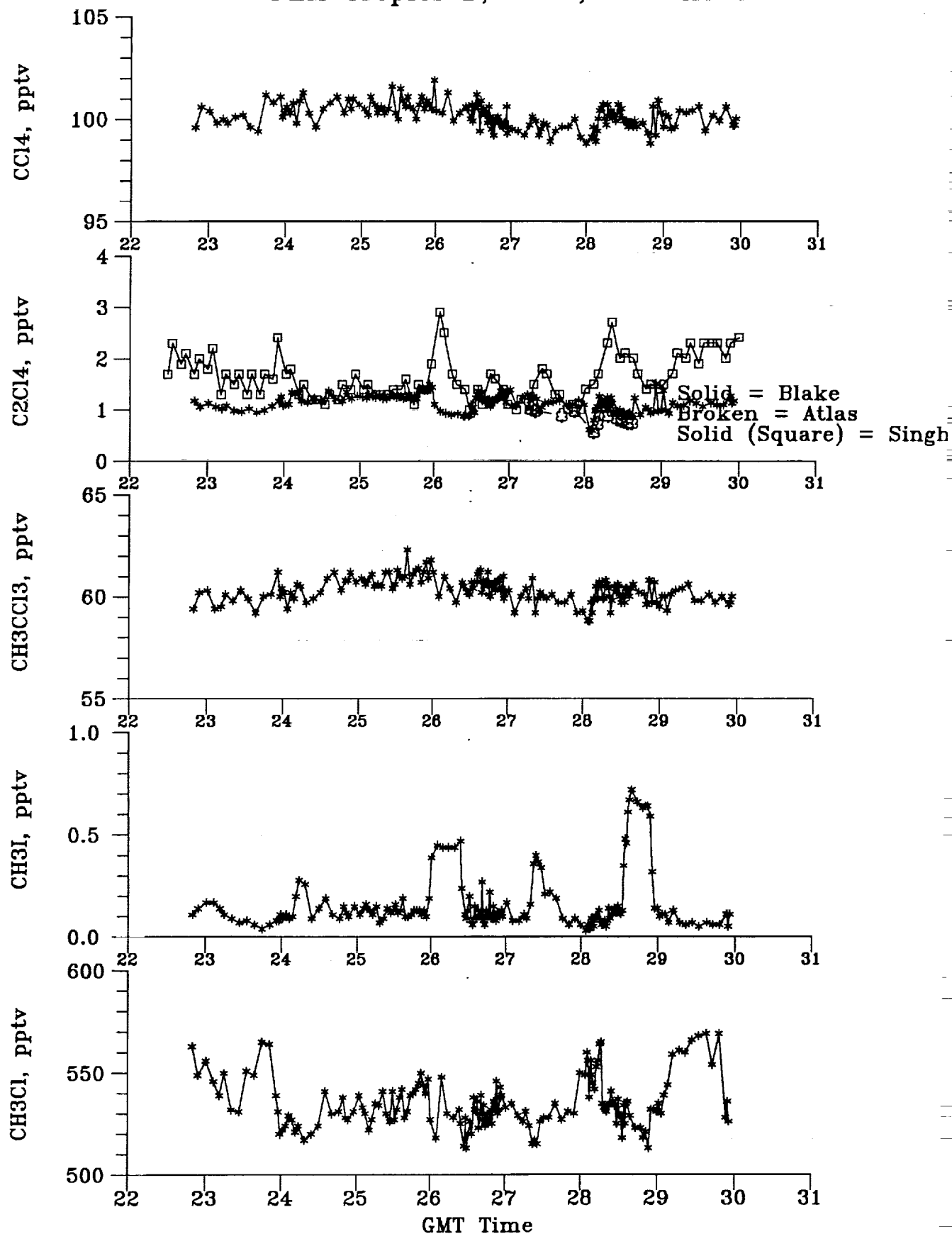
PEM Tropics B; DC-8; FLIGHT 10



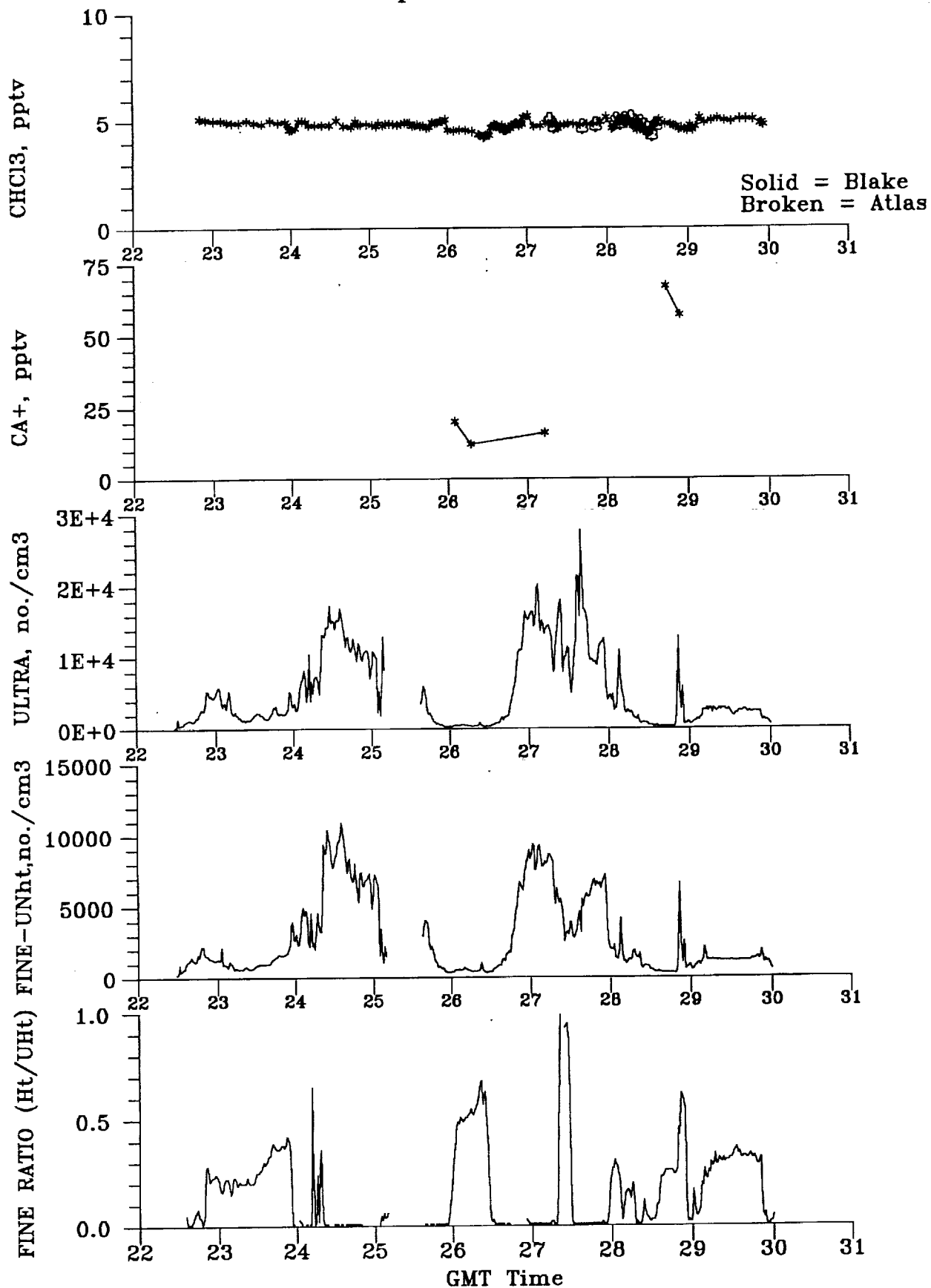
PEM Tropics B; DC-8; FLIGHT 10



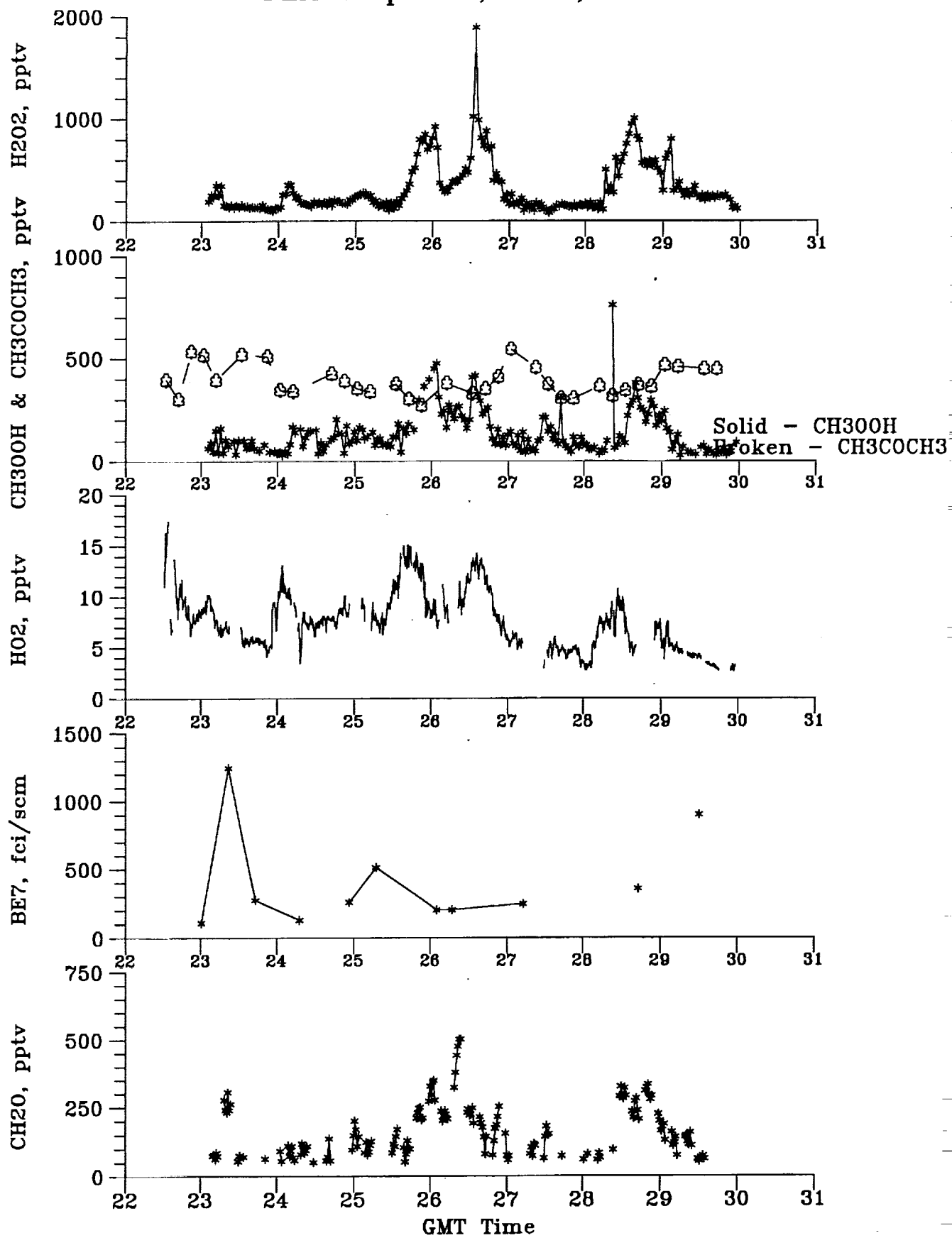
PEM Tropics B; DC-8; FLIGHT 10



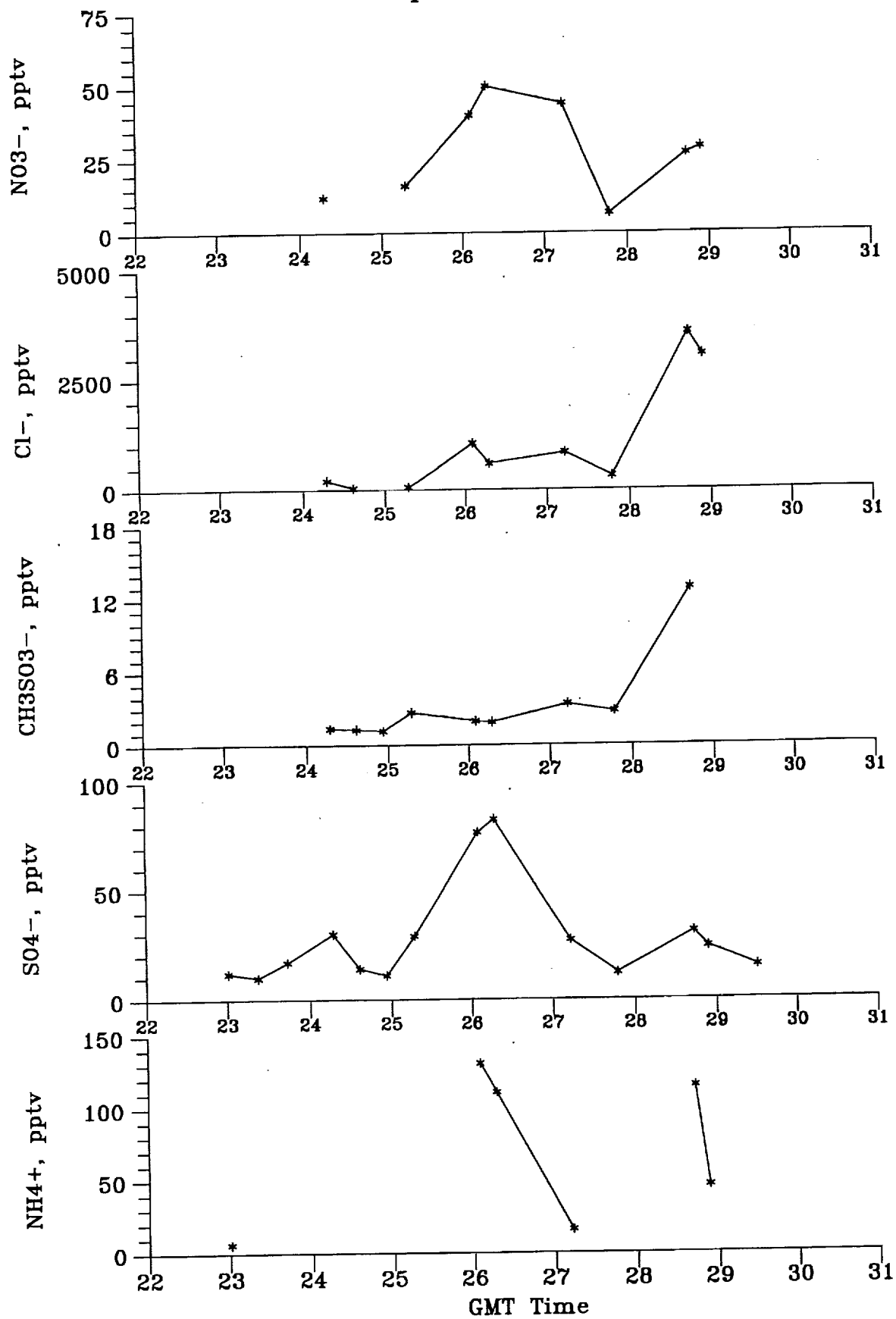
PEM Tropics B; DC-8; FLIGHT 10



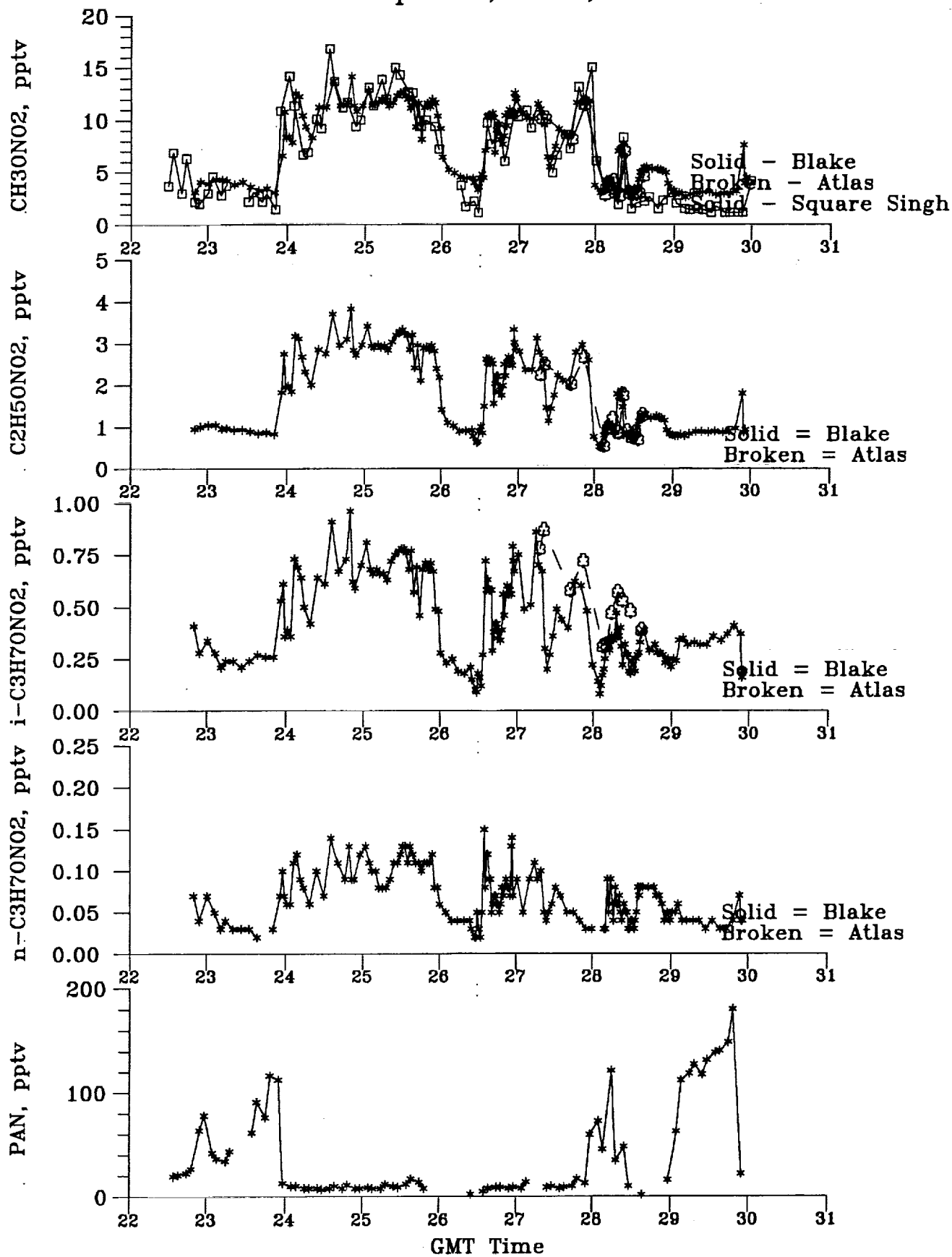
PEM Tropics B; DC-8; FLIGHT 10



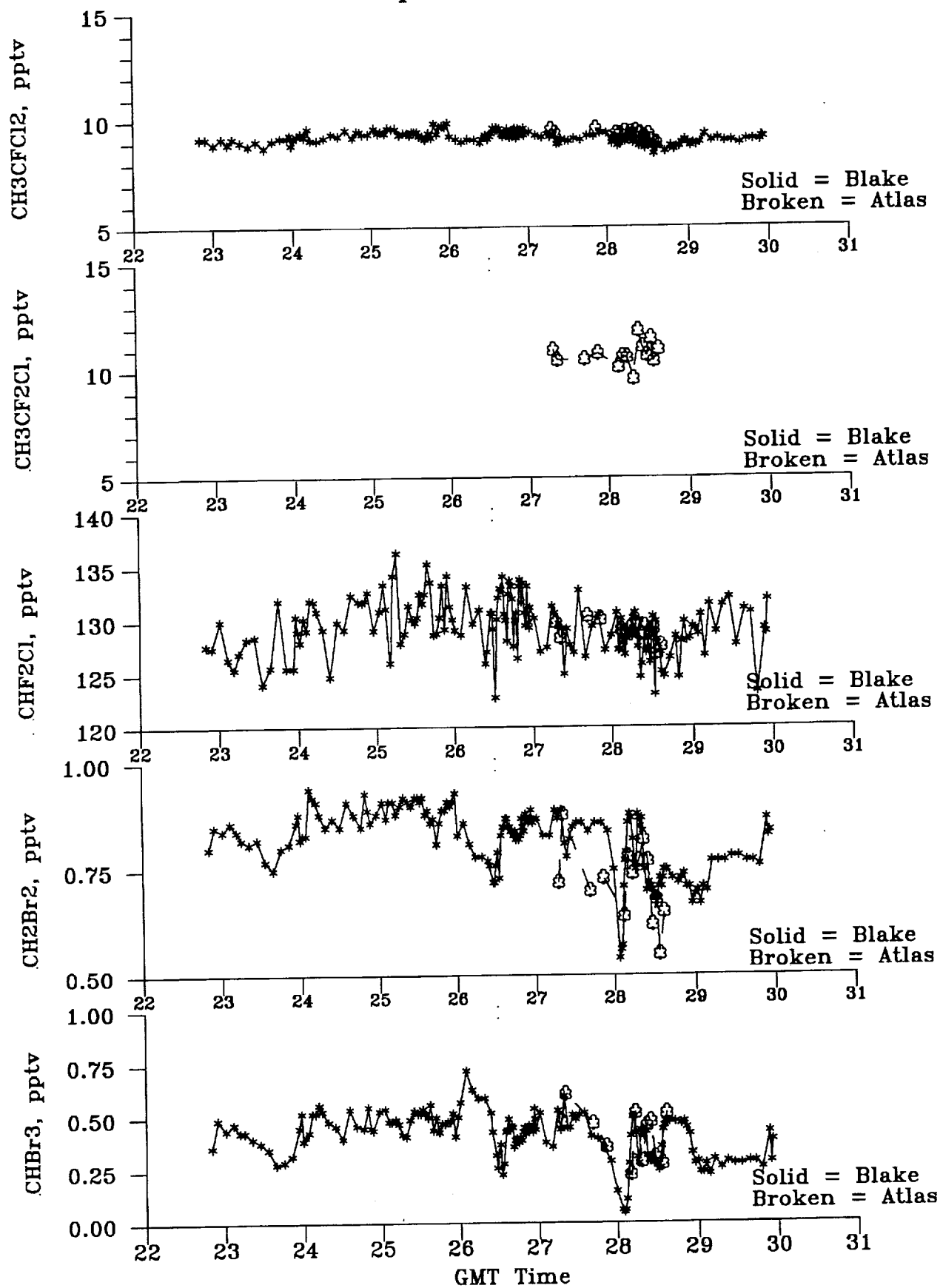
PEM Tropics B; DC-8; FLIGHT 10



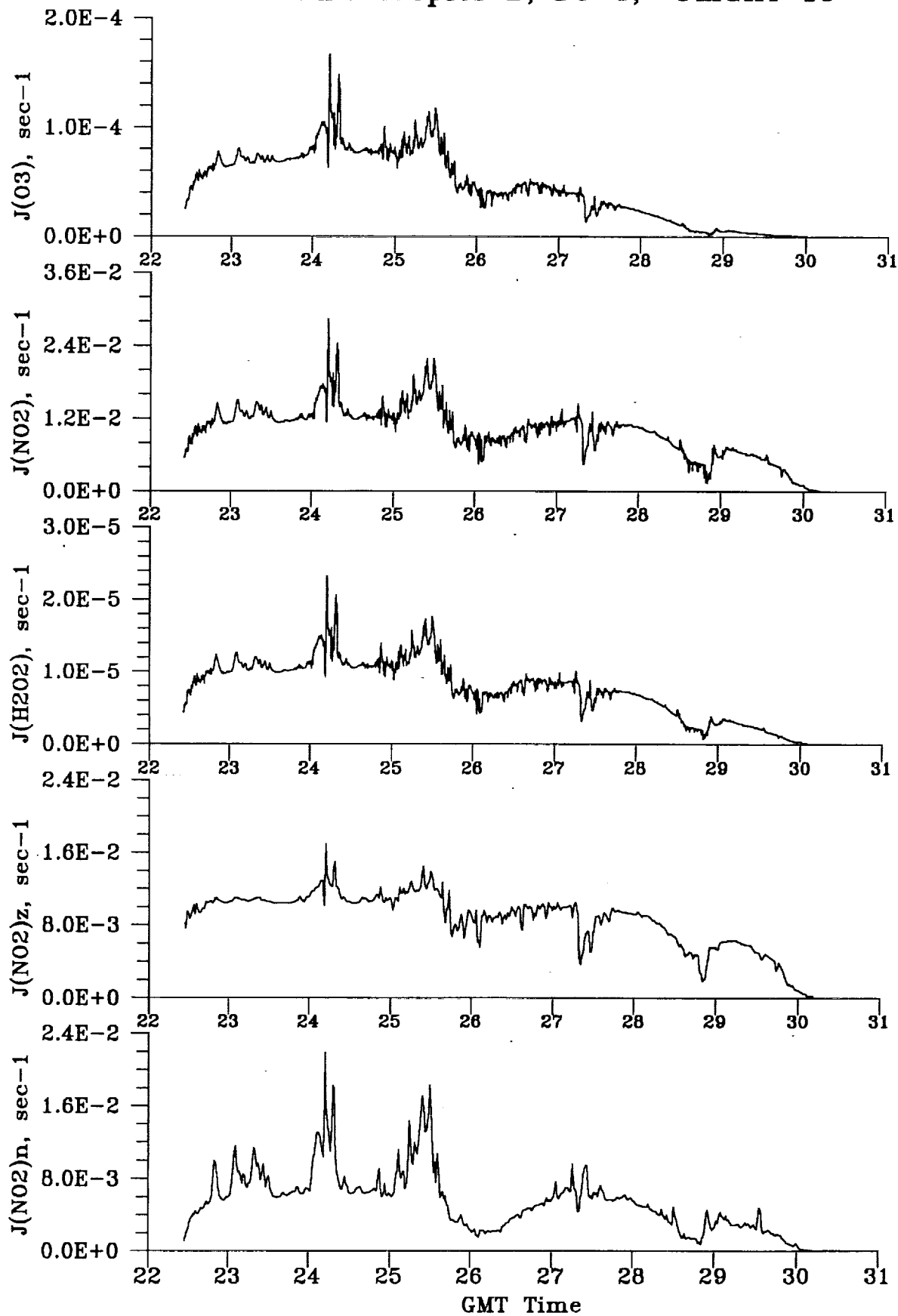
PEM Tropics B; DC-8; FLIGHT 10



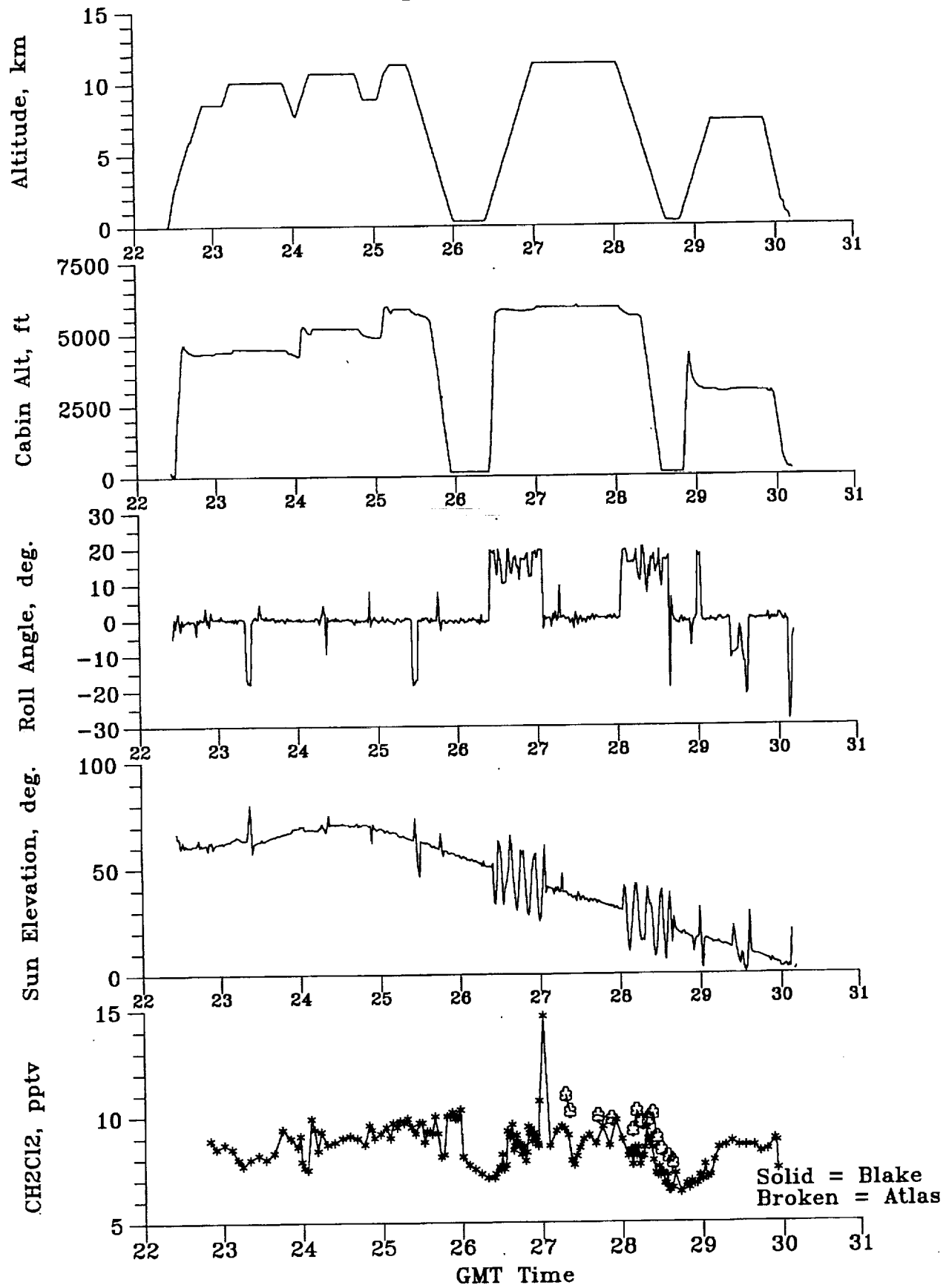
PEM Tropics B; DC-8; FLIGHT 10



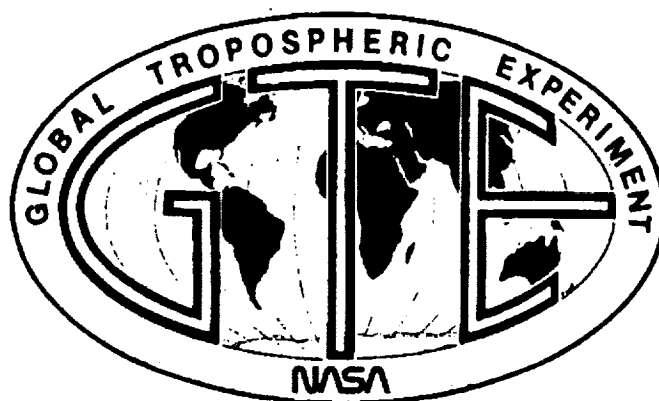
PEM Tropics B; DC-8; FLIGHT 10



PEM Tropics B; DC-8; FLIGHT 10



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

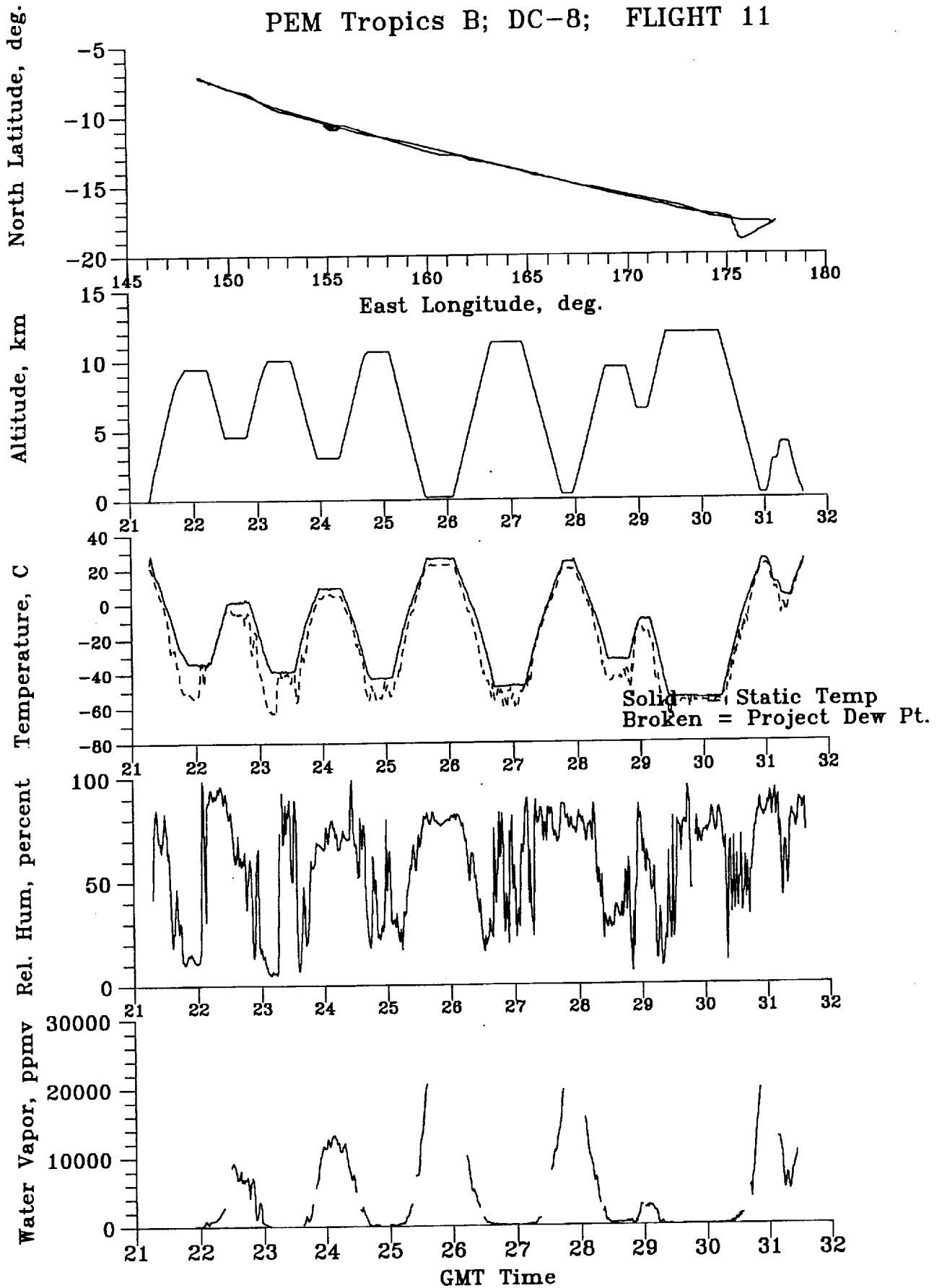
Flight 11D

Local: Fiji No. 2

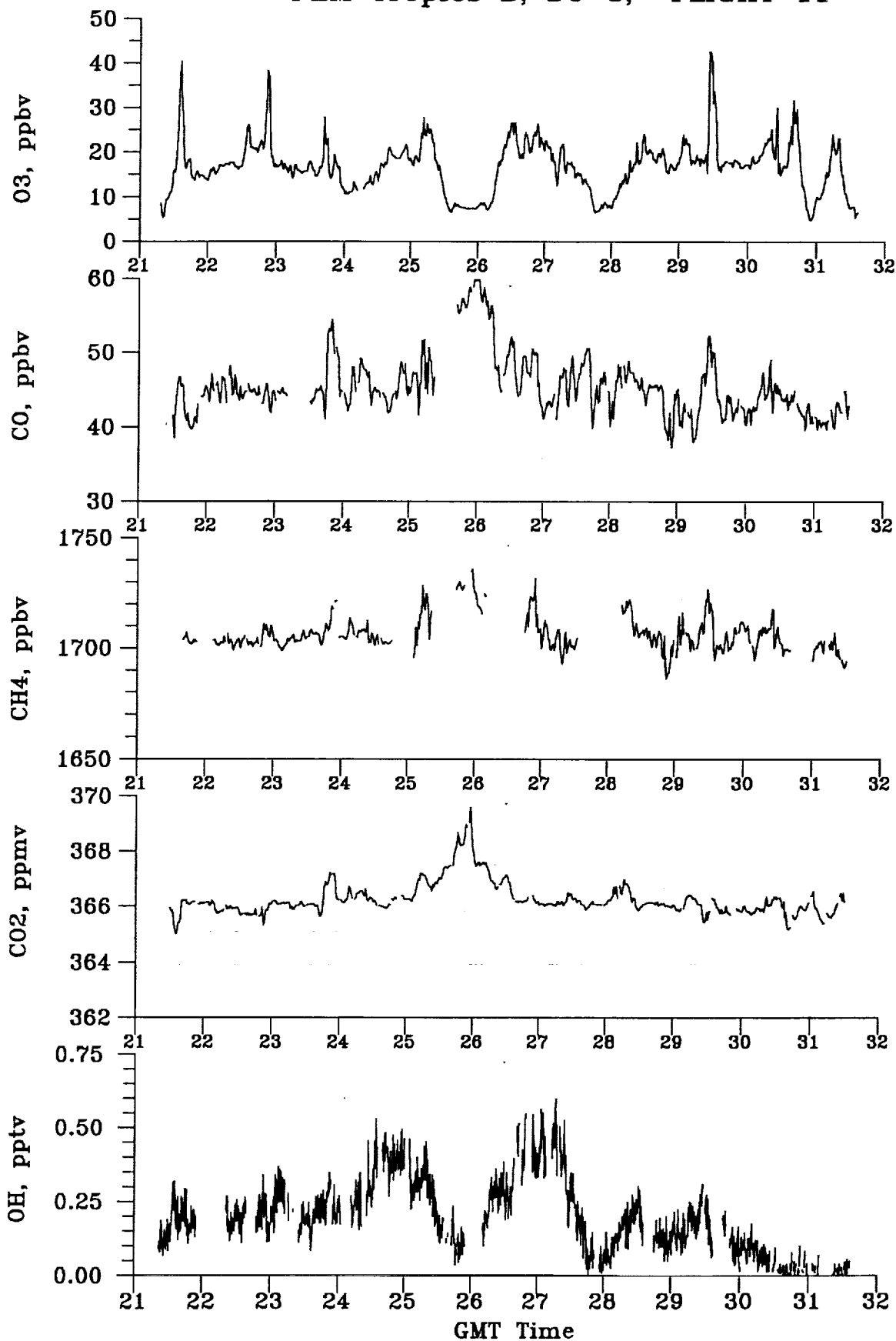
Ozone Trough

March 22, 1999

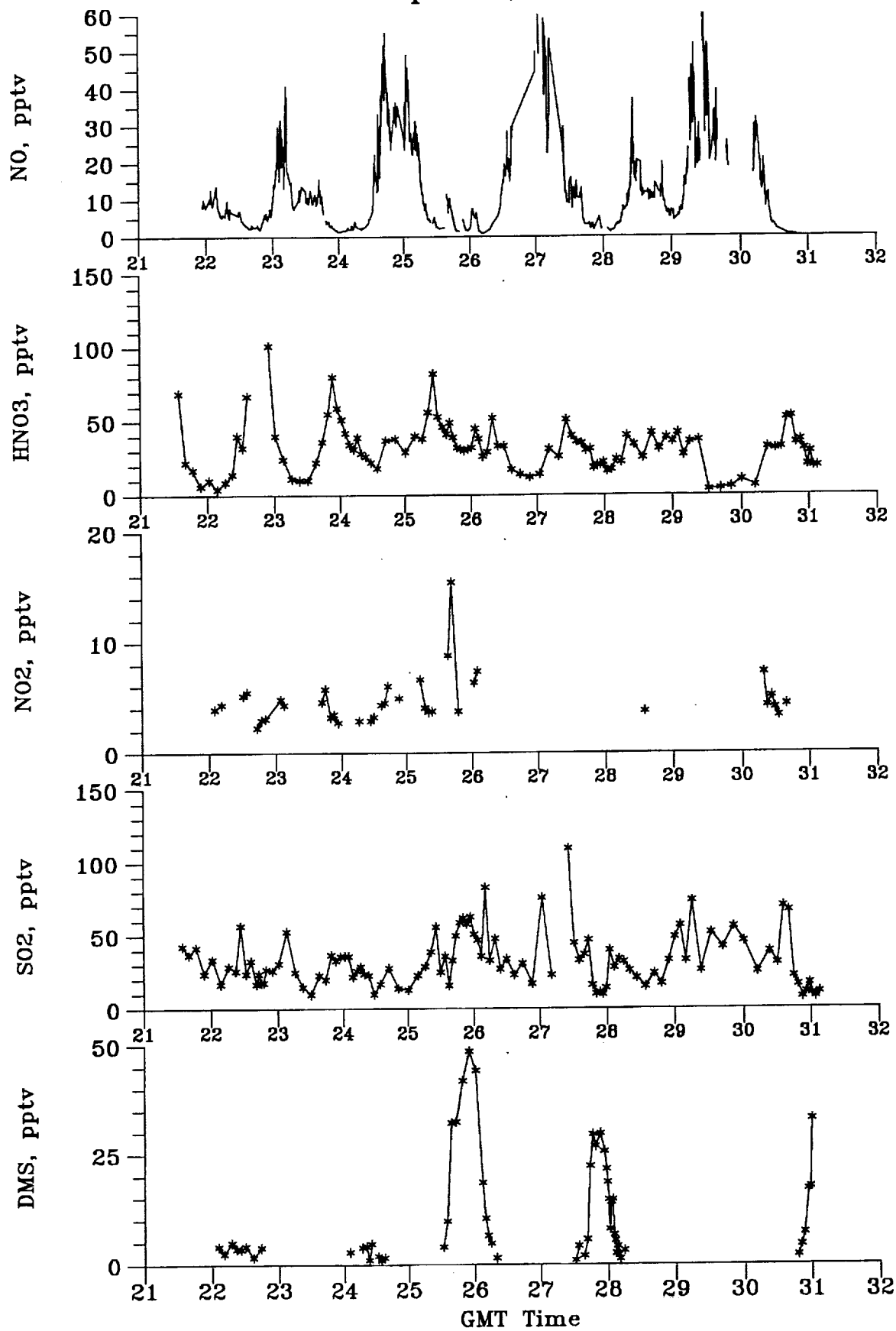
PEM Tropics B; DC-8; FLIGHT 11



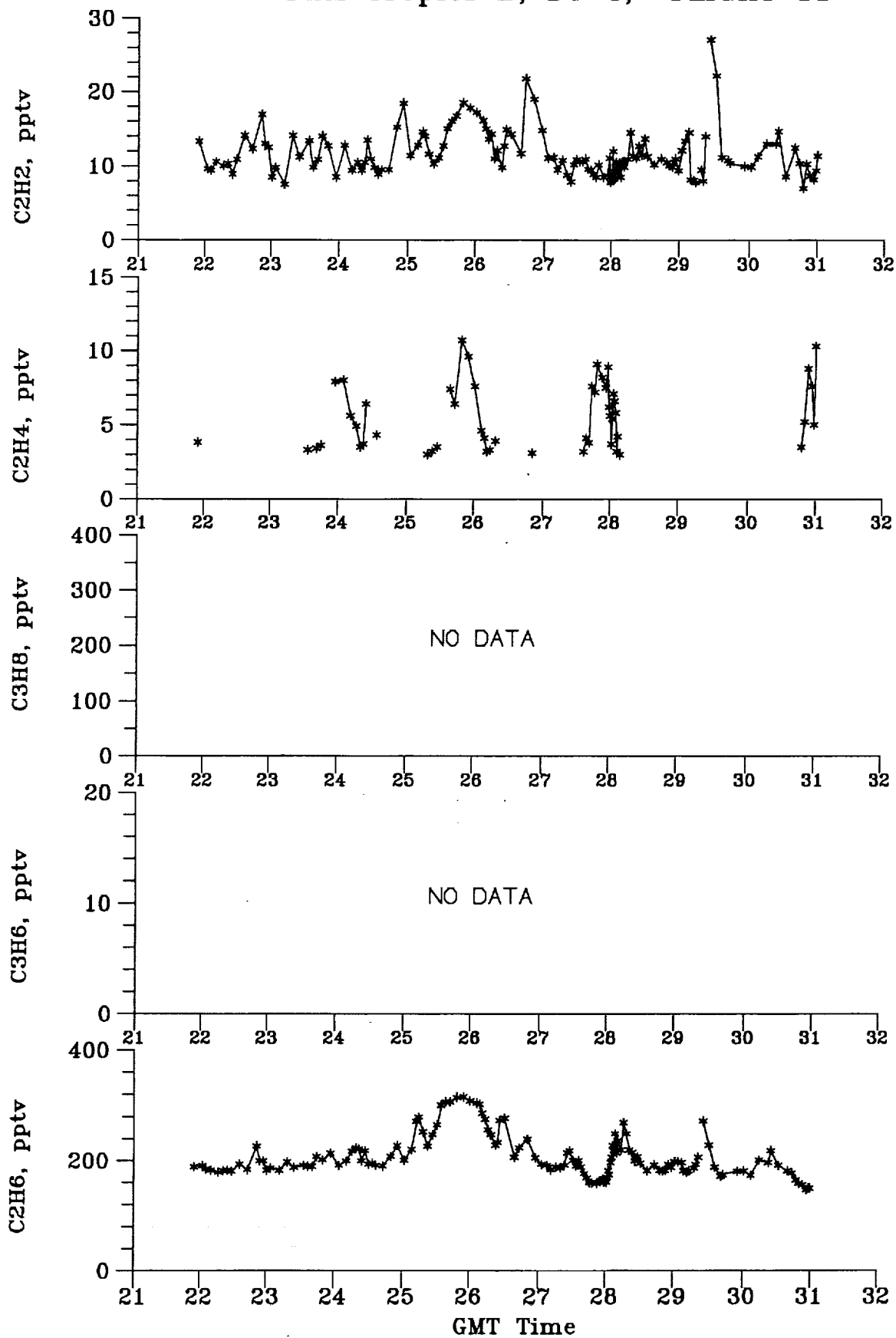
PEM Tropics B; DC-8; FLIGHT 11



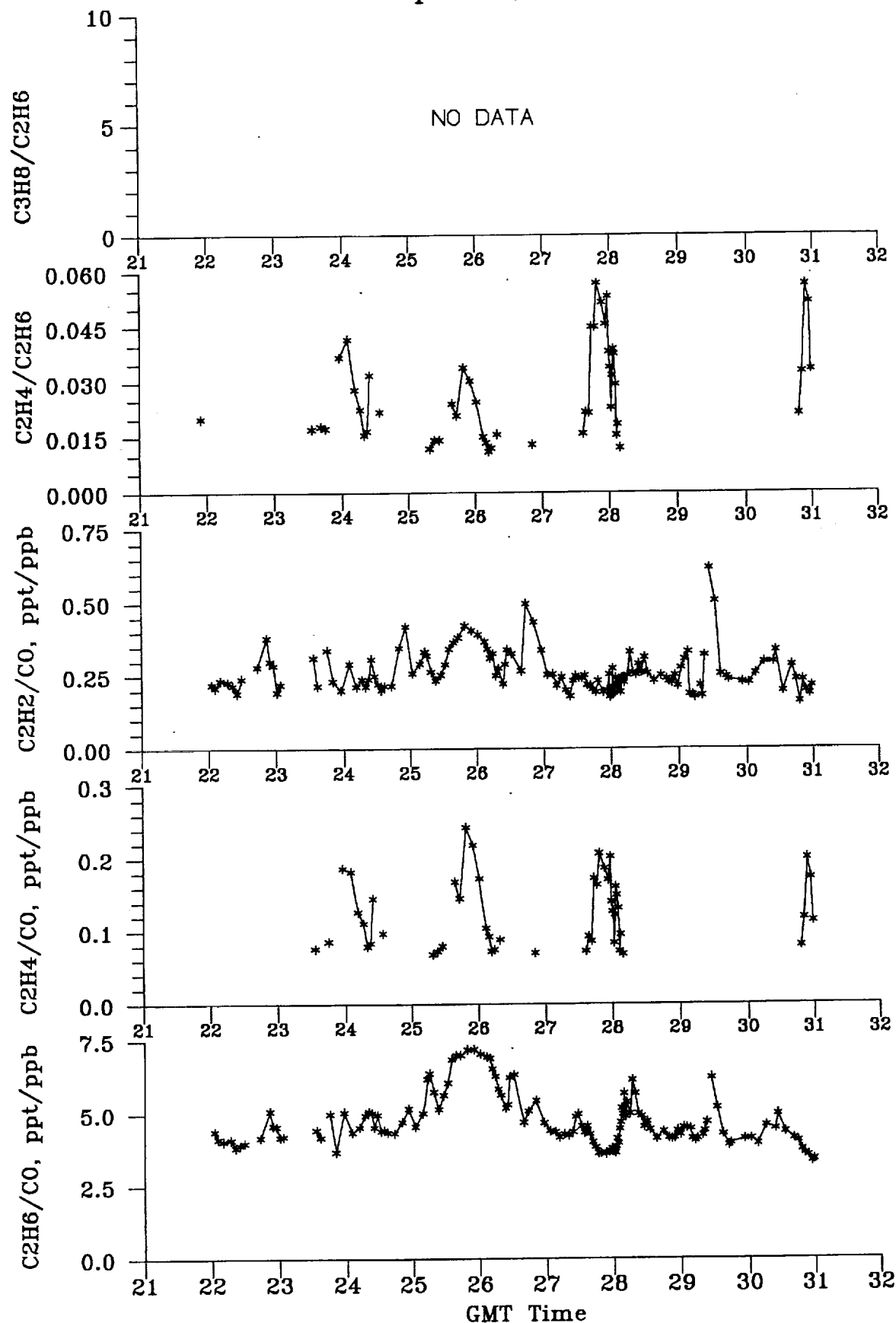
PEM Tropics B; DC-8; FLIGHT 11



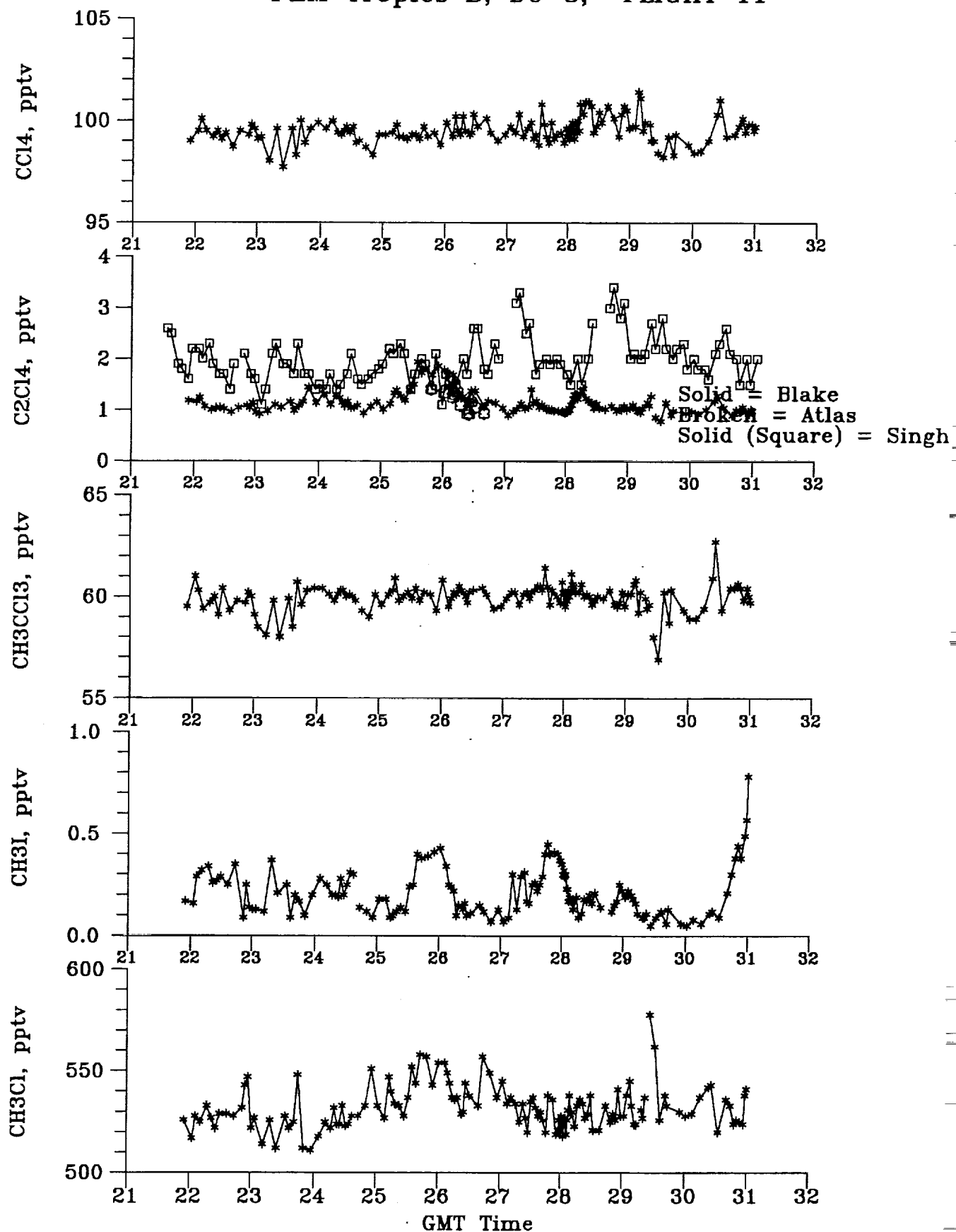
PEM Tropics B; DC-8; FLIGHT 11



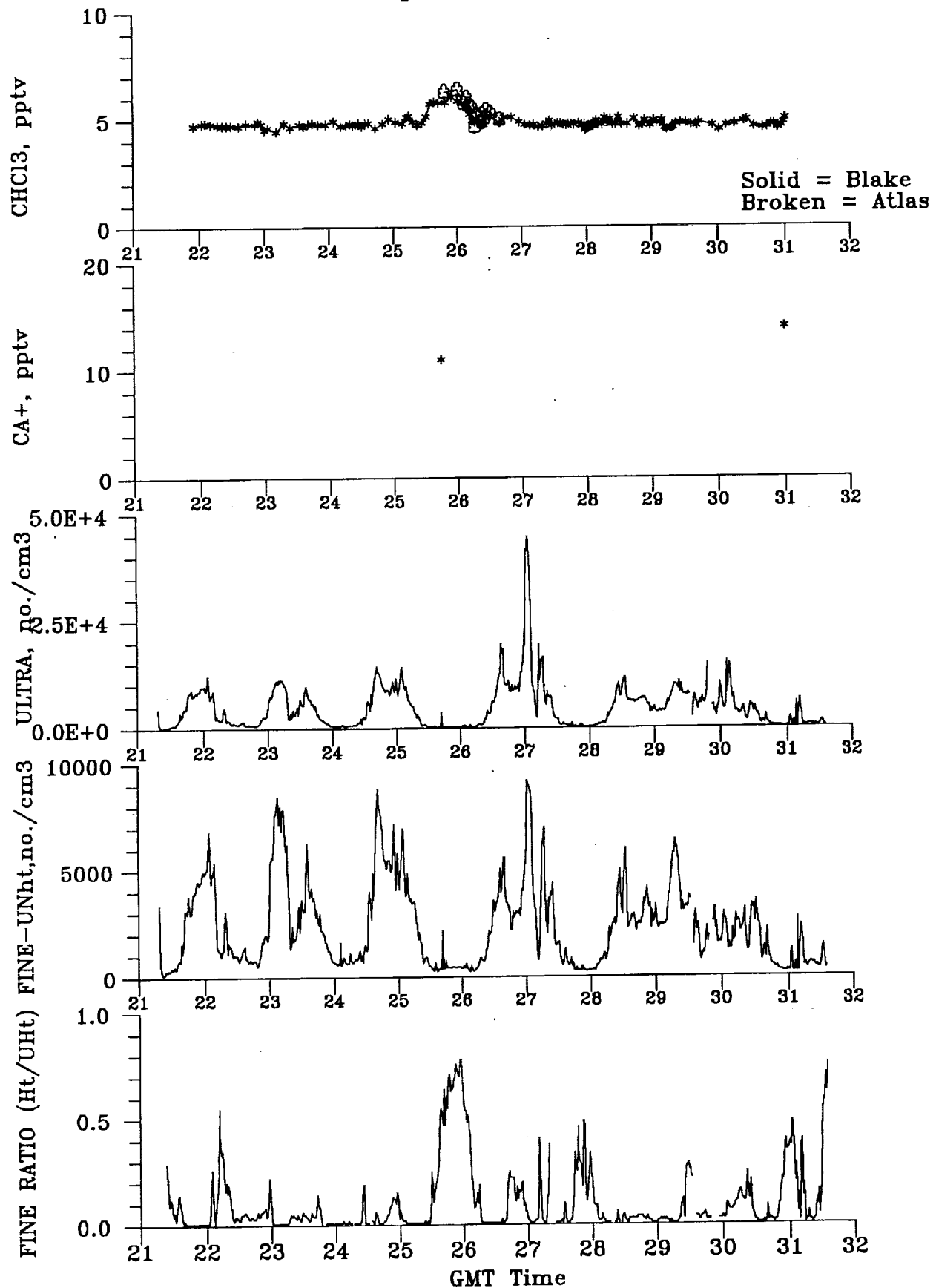
PEM Tropics B; DC-8; FLIGHT 11



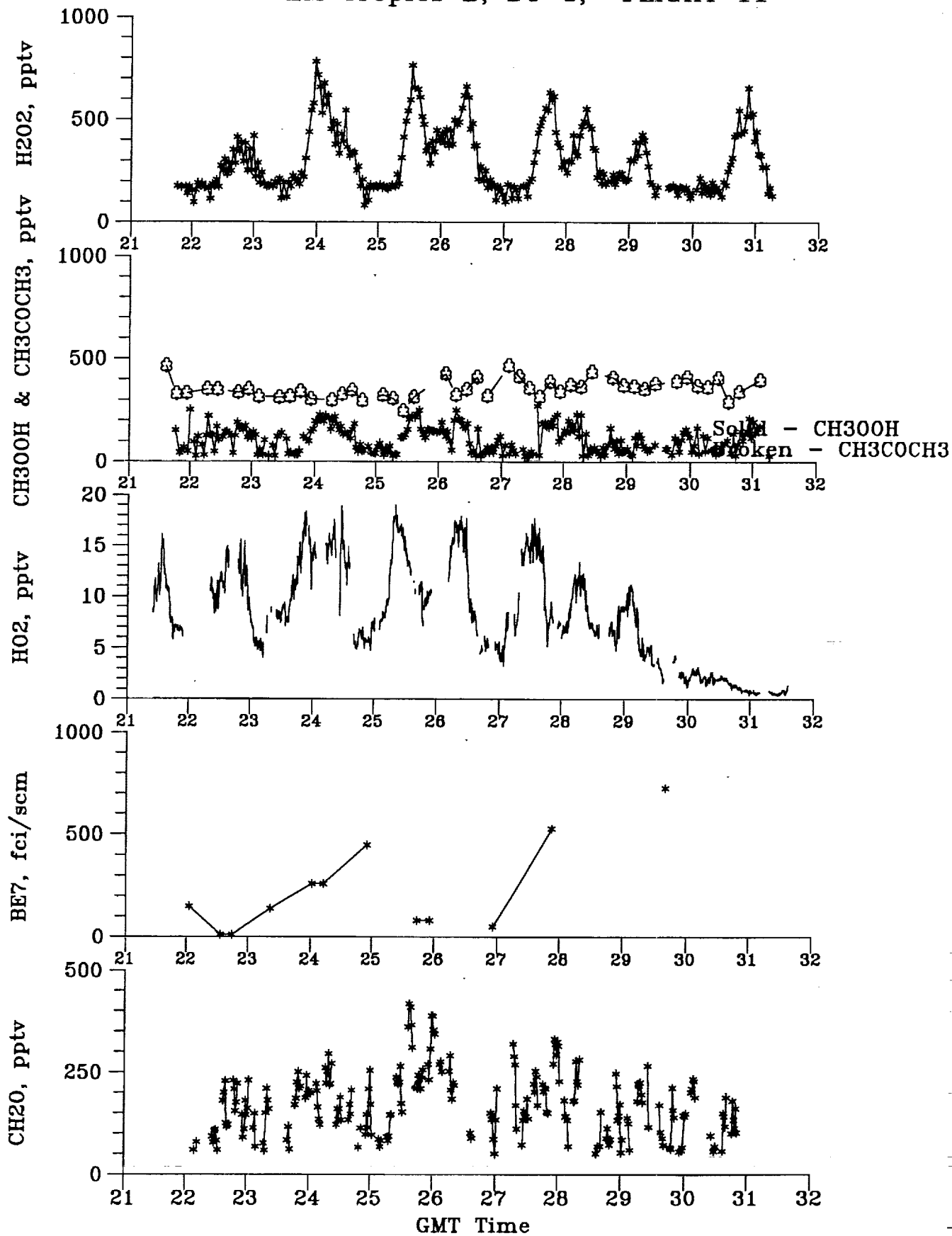
PEM Tropics B; DC-8; FLIGHT 11



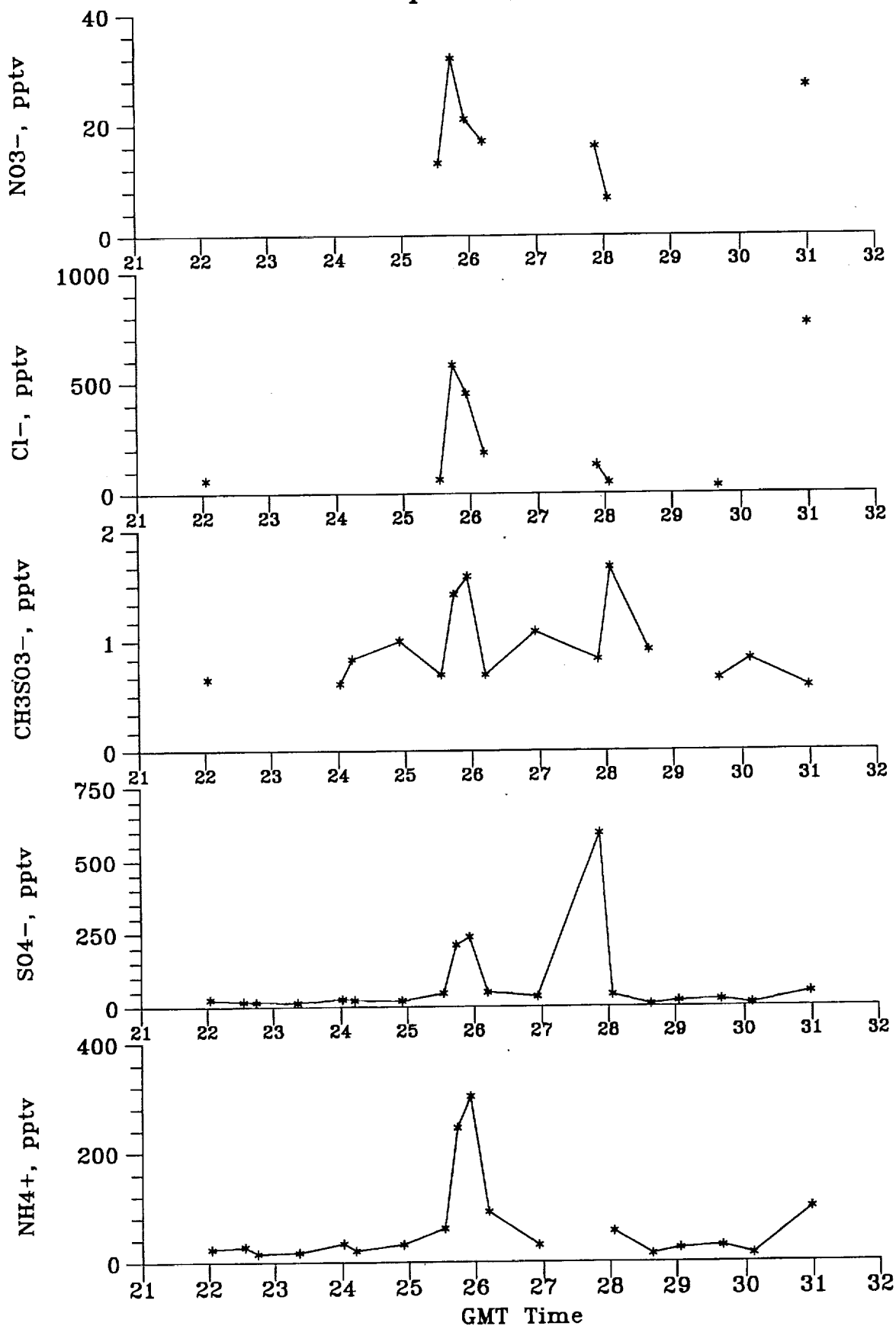
PEM Tropics B; DC-8; FLIGHT 11



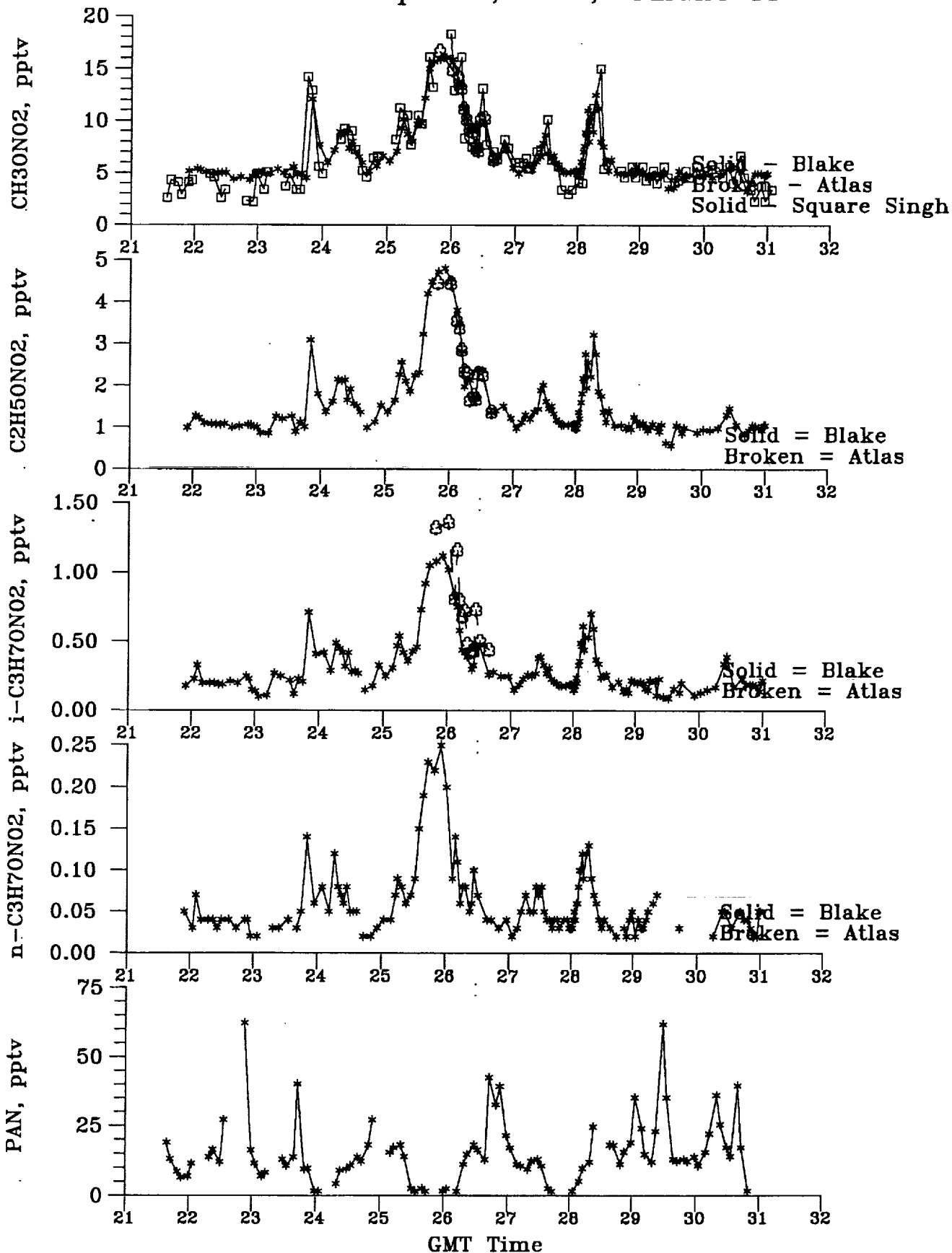
PEM Tropics B; DC-8; FLIGHT 11



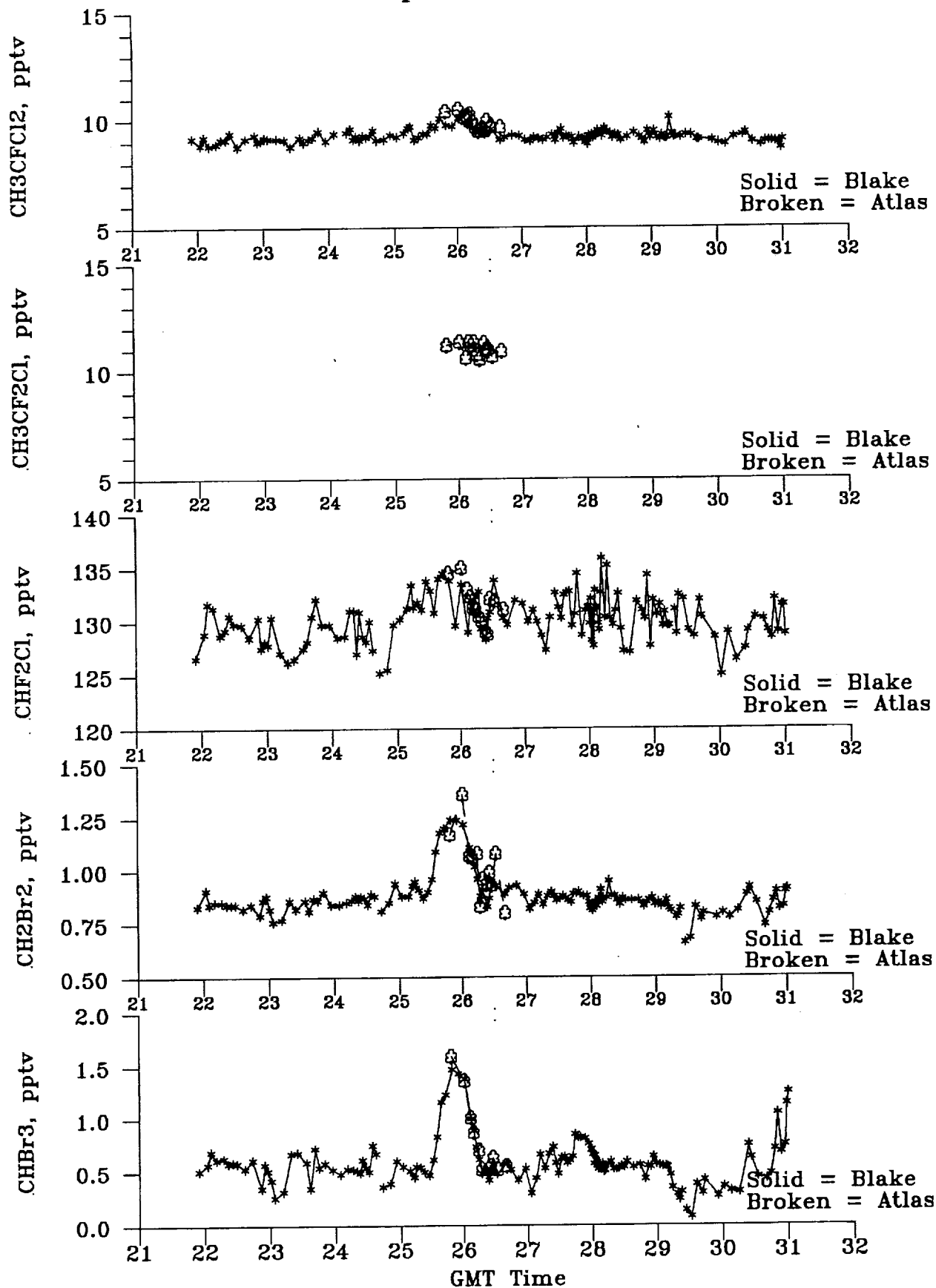
PEM Tropics B; DC-8; FLIGHT 11



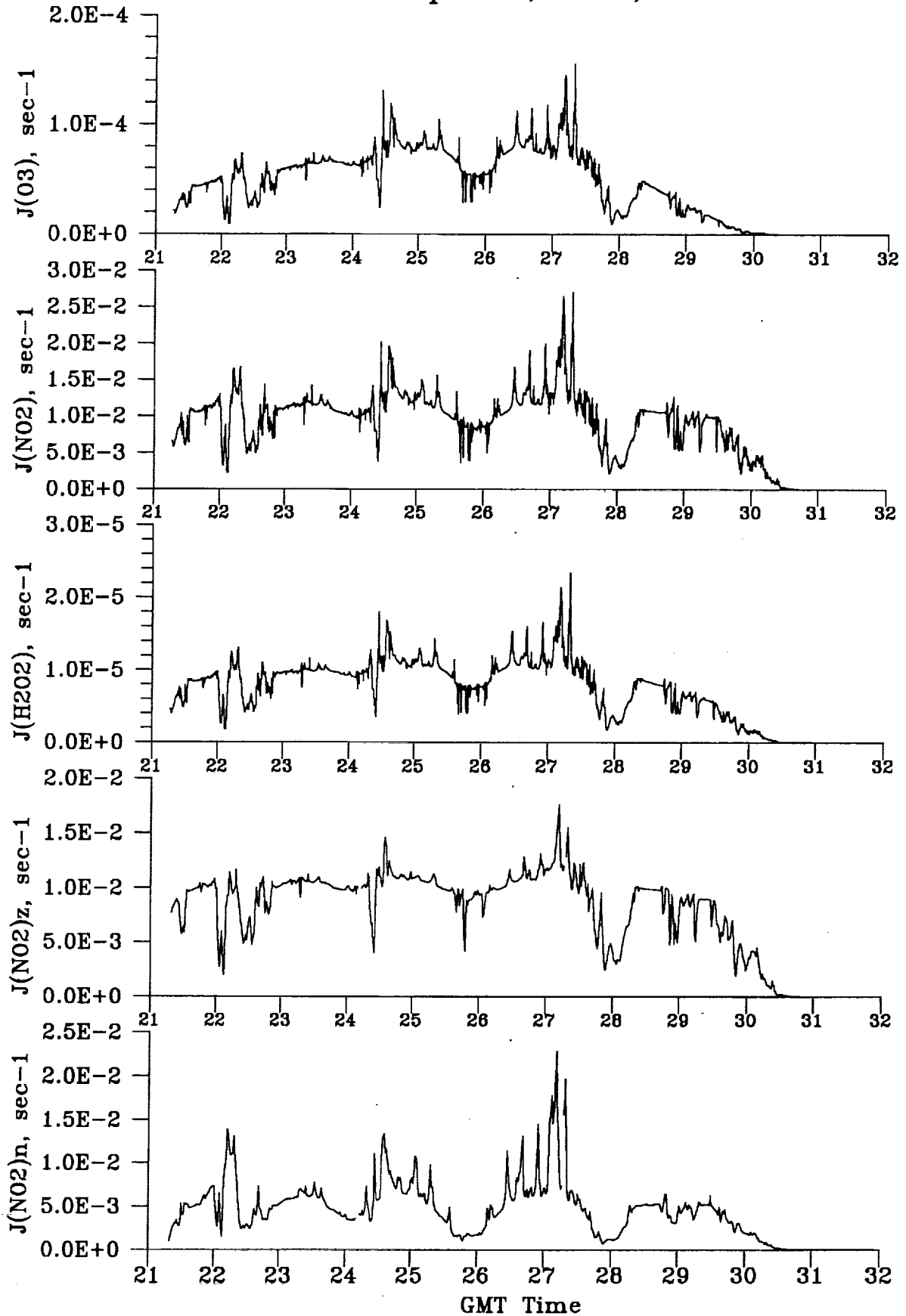
PEM Tropics B; DC-8; FLIGHT 11



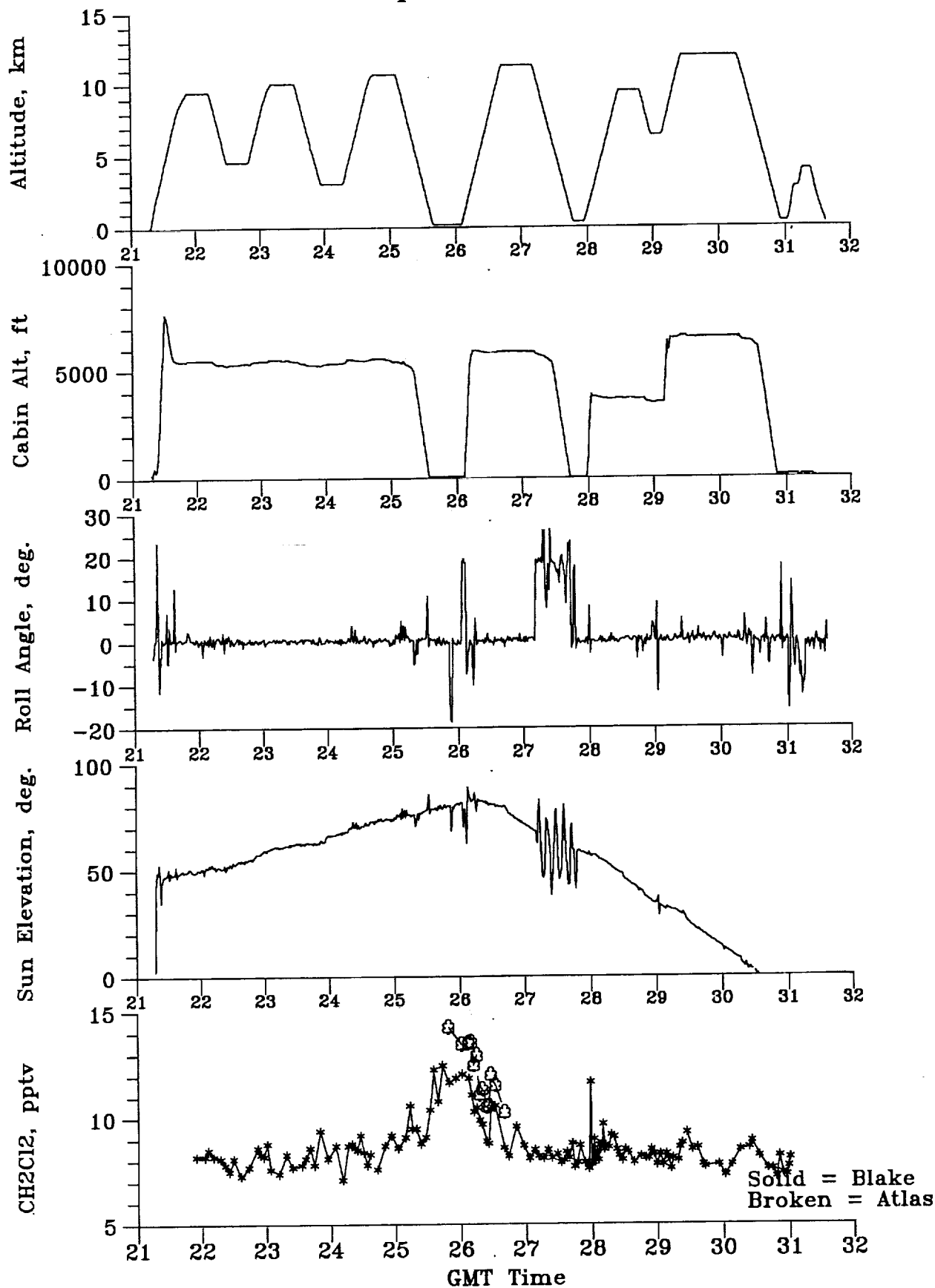
PEM Tropics B; DC-8; FLIGHT 11



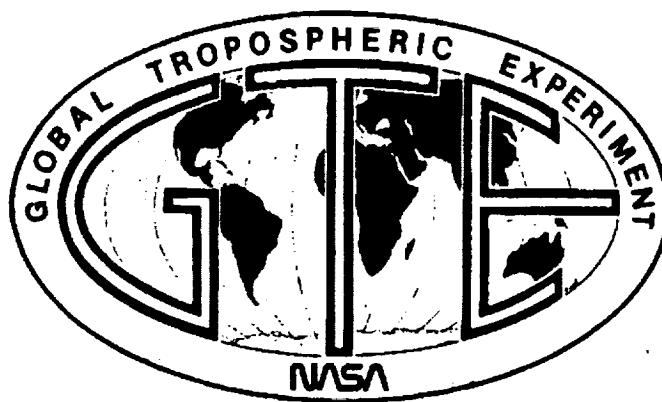
PEM Tropics B; DC-8; FLIGHT 11



PEM Tropics B; DC-8; FLIGHT 11



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

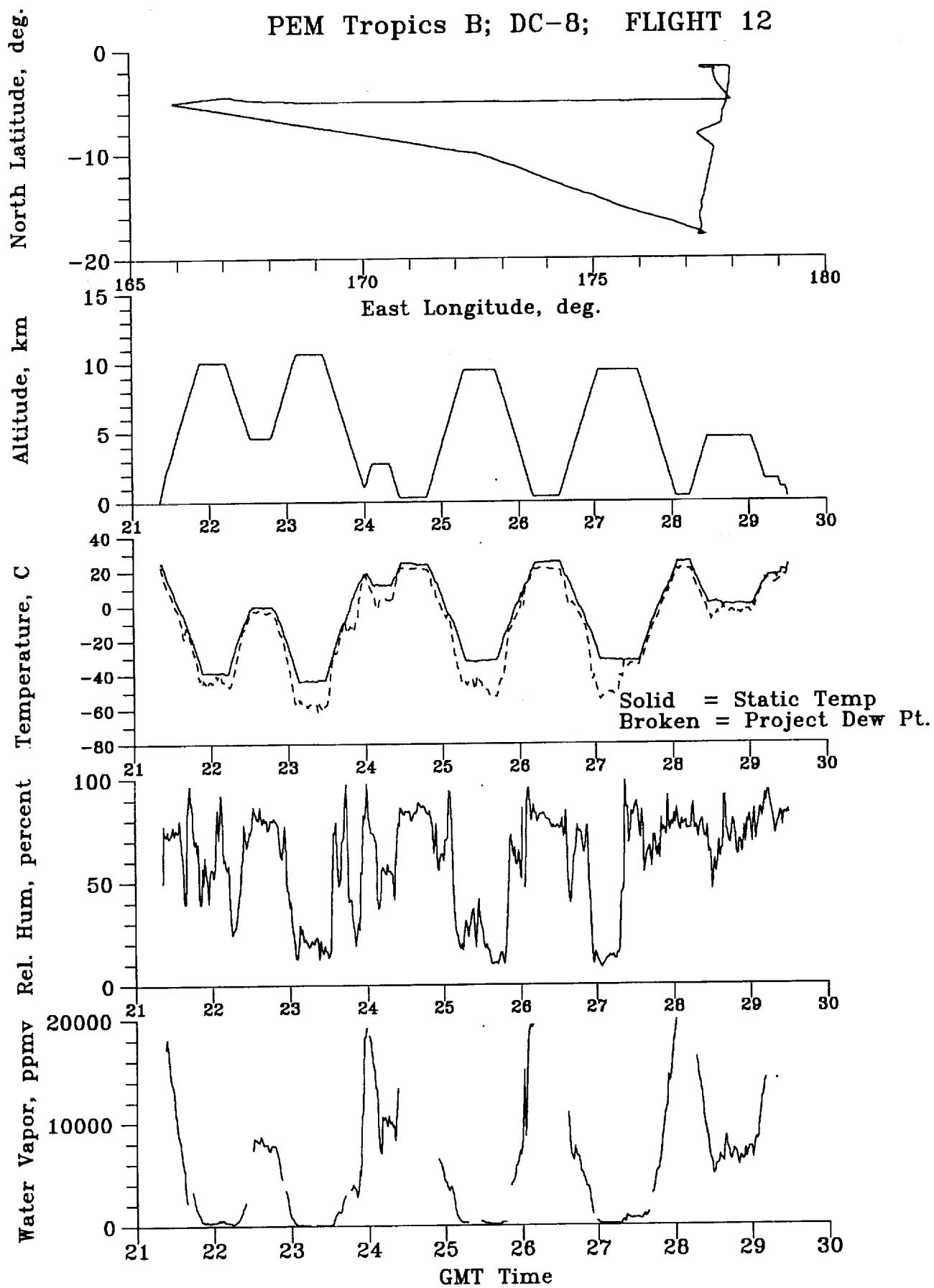
Flight 12D

Local: Fiji No. 3

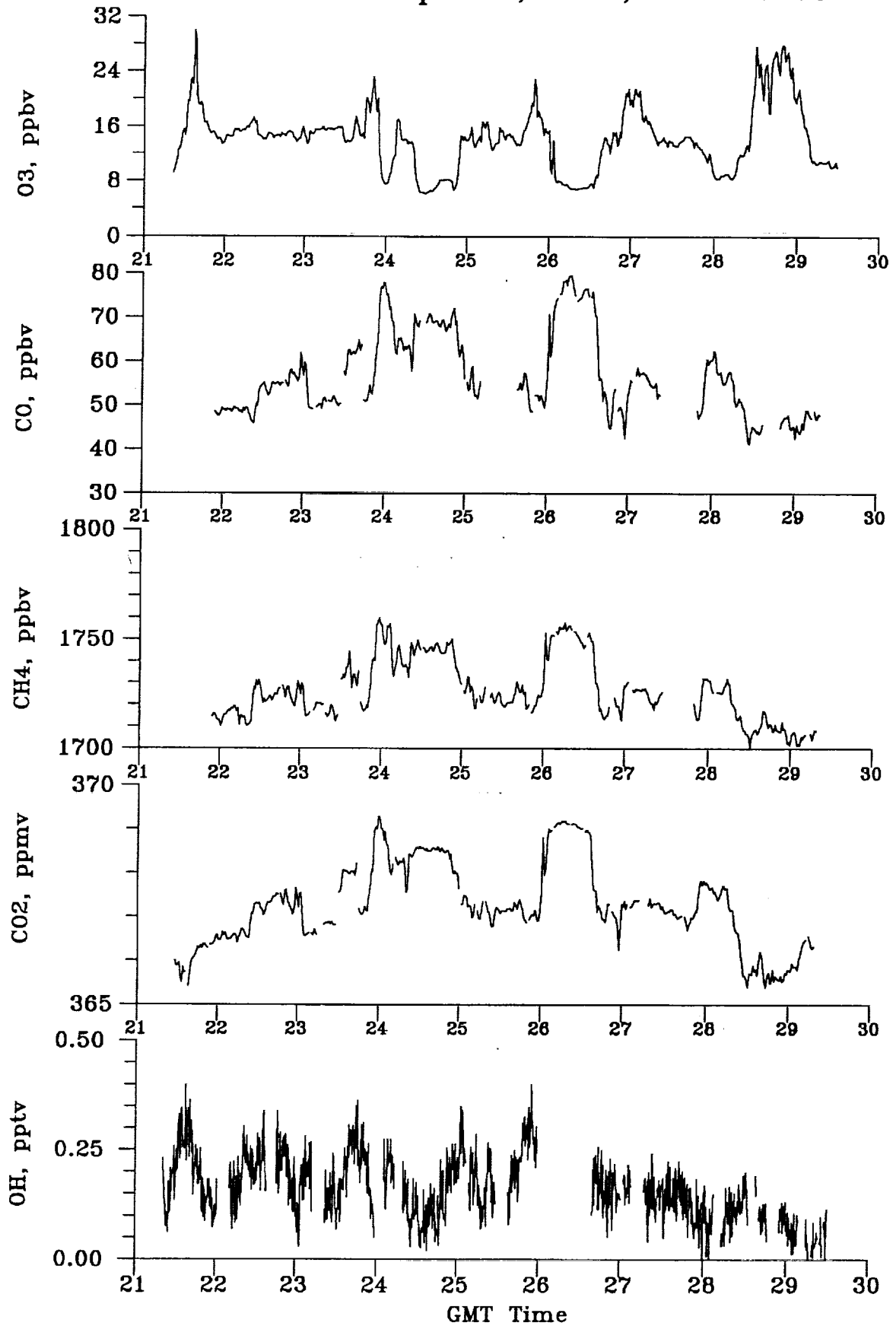
Photochemical Aging of Air

March 24, 1999

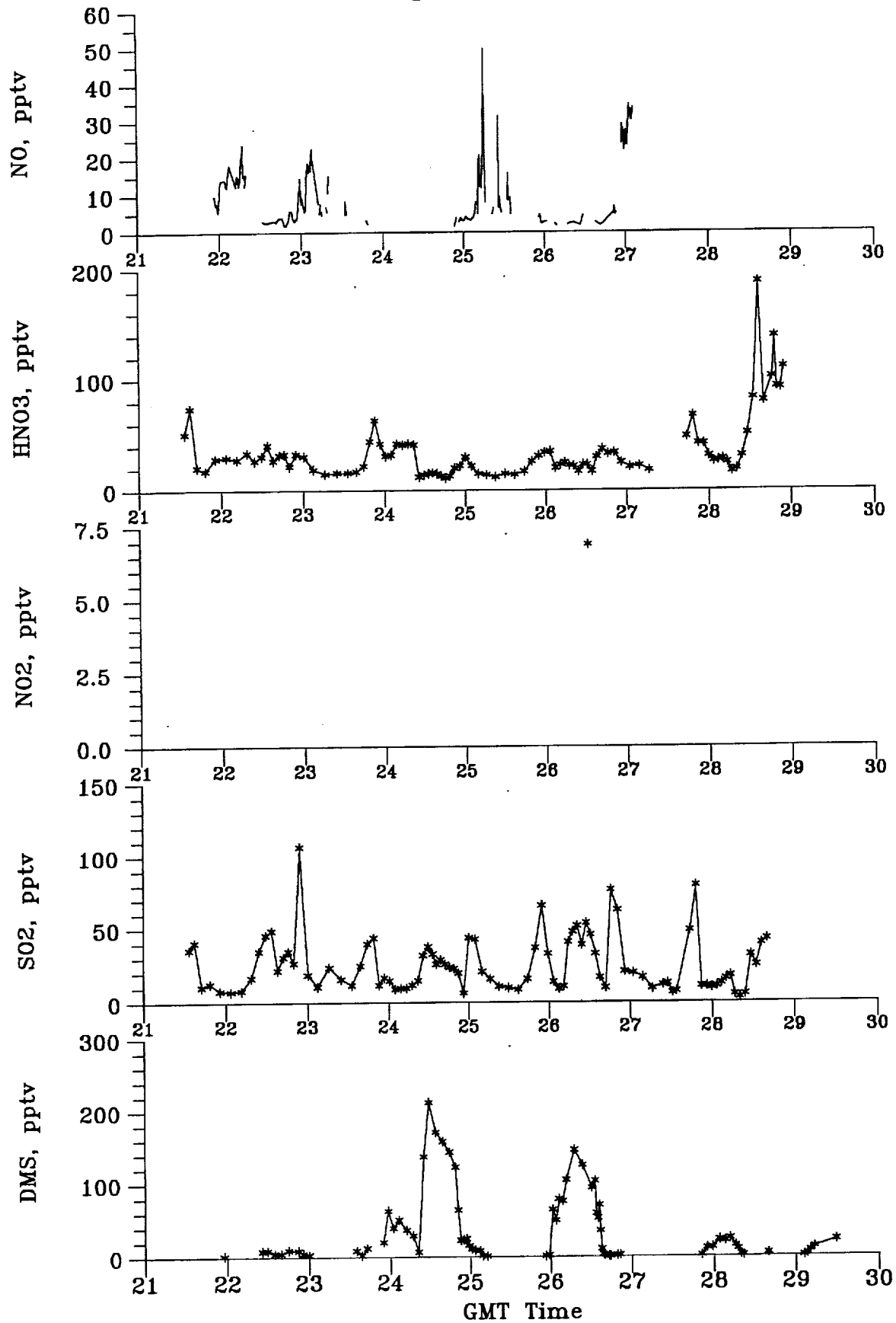
PEM Tropics B; DC-8; FLIGHT 12



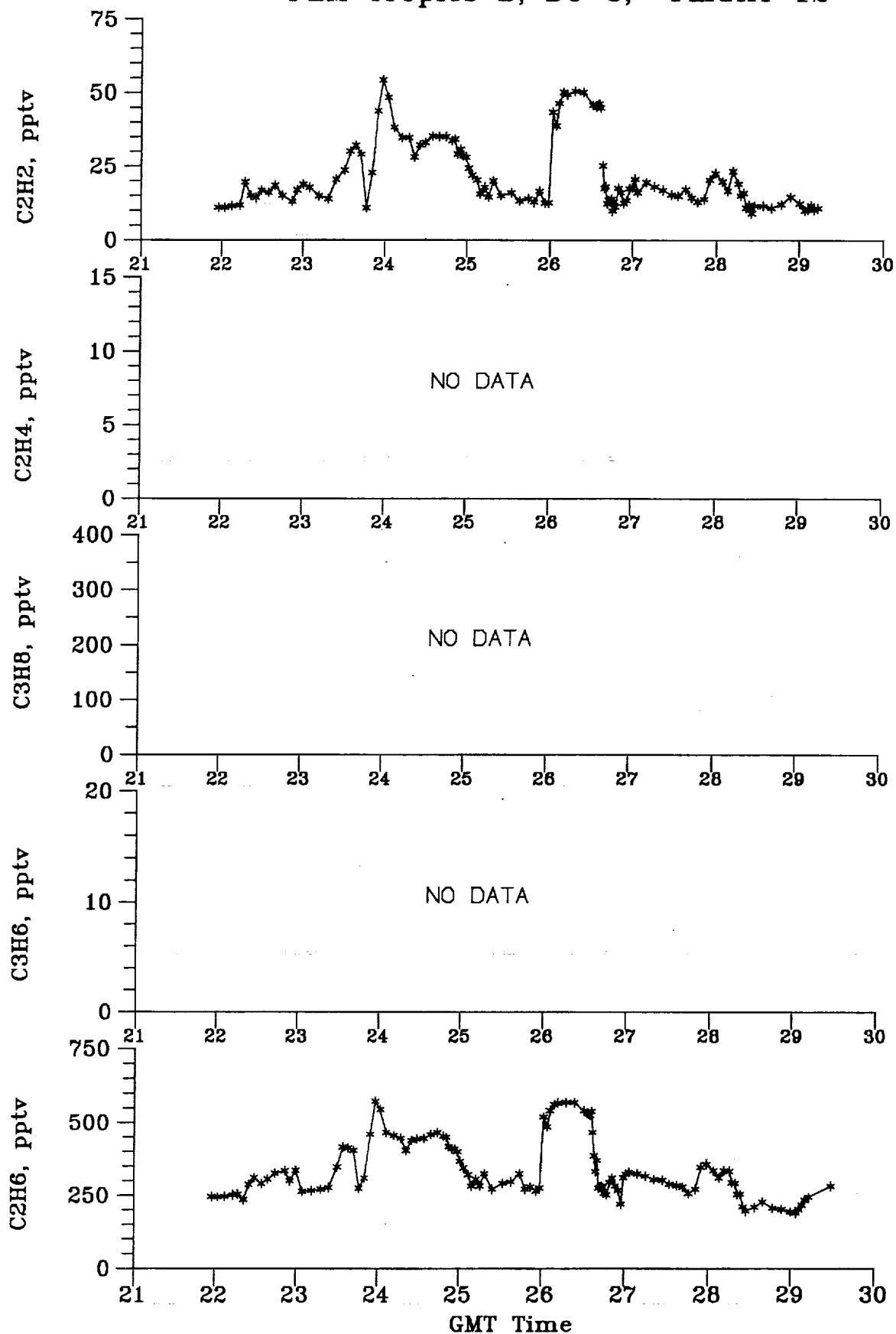
PEM Tropics B; DC-8; FLIGHT 12



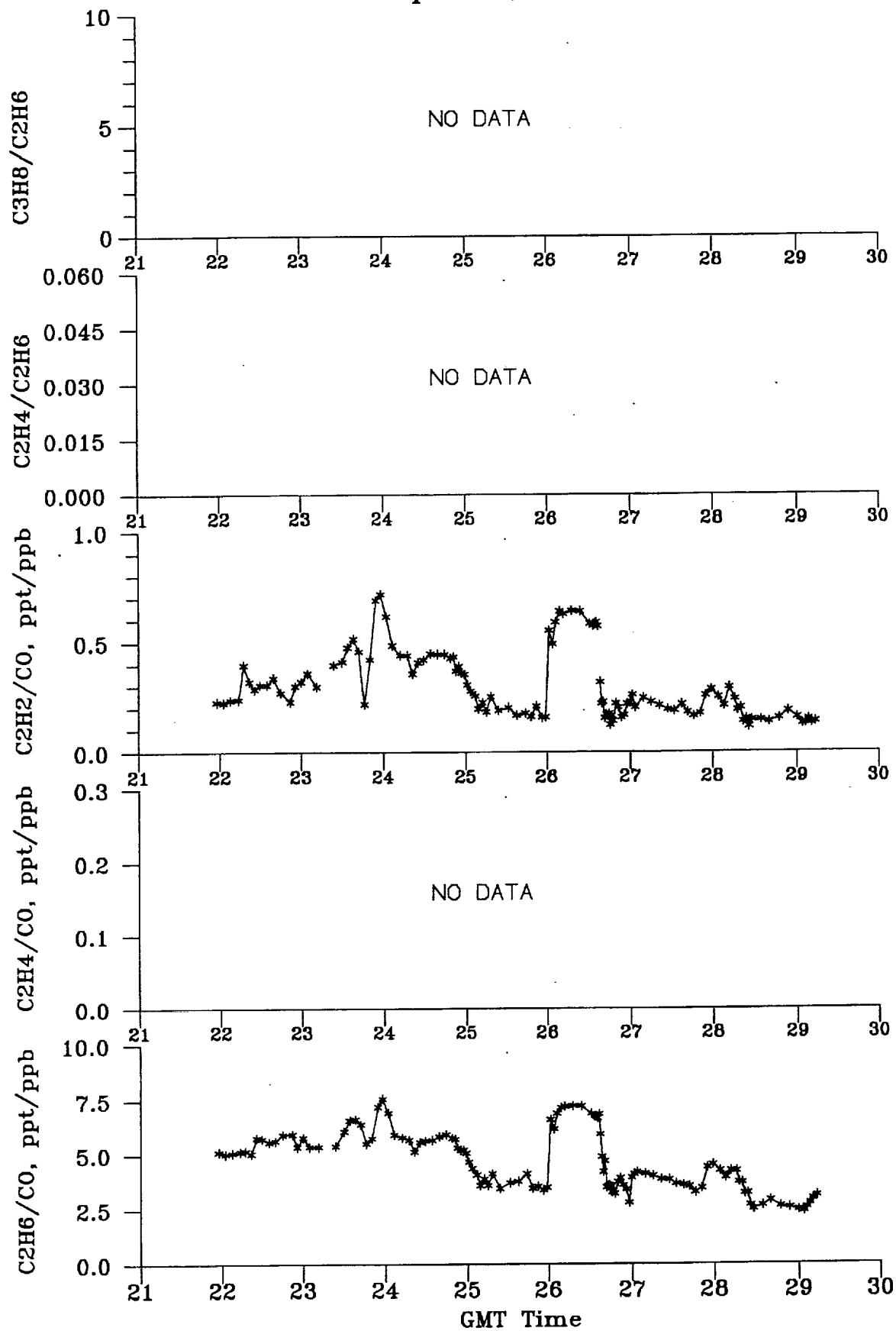
PEM Tropics B; DC-8; FLIGHT 12



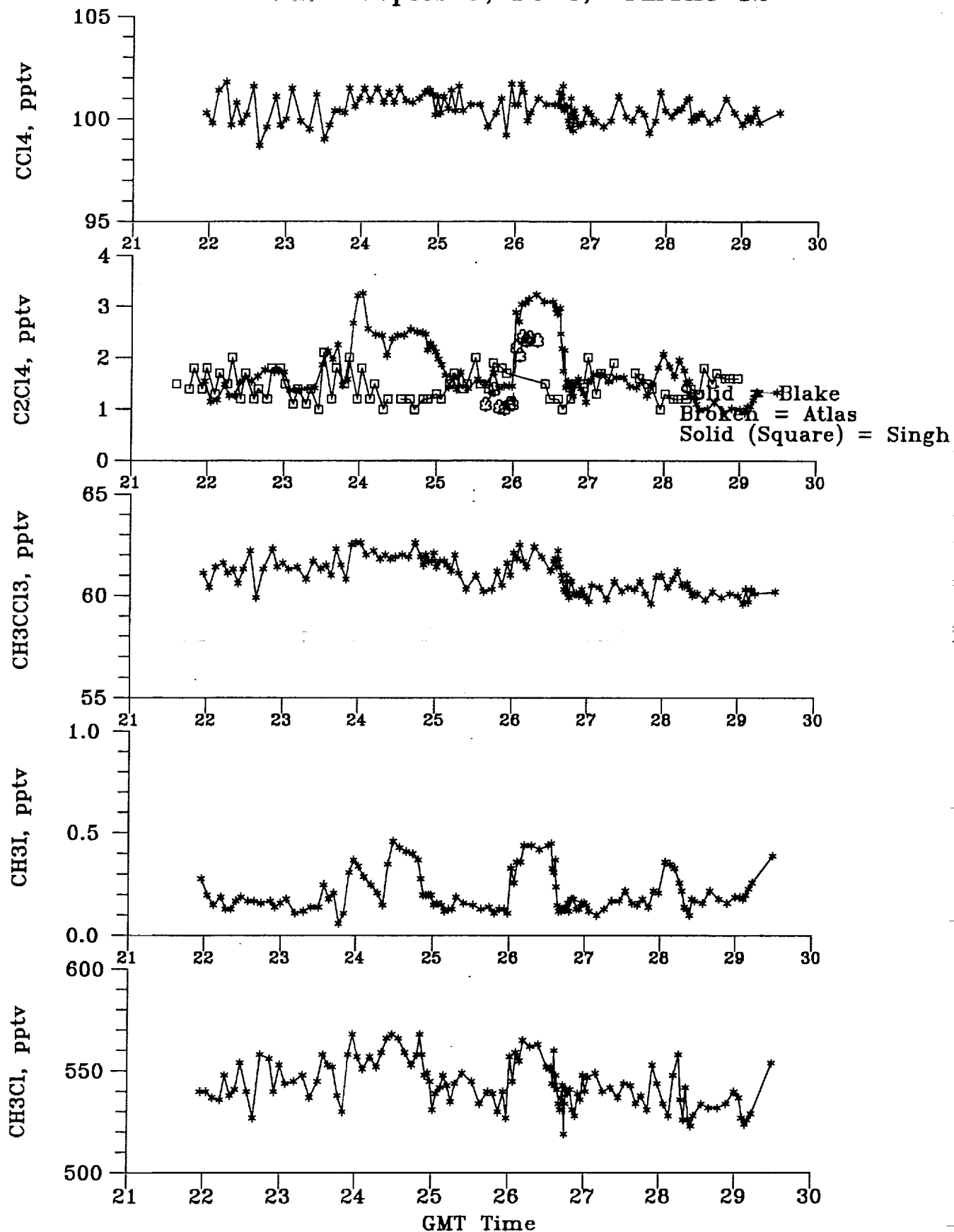
PEM Tropics B; DC-8; FLIGHT 12



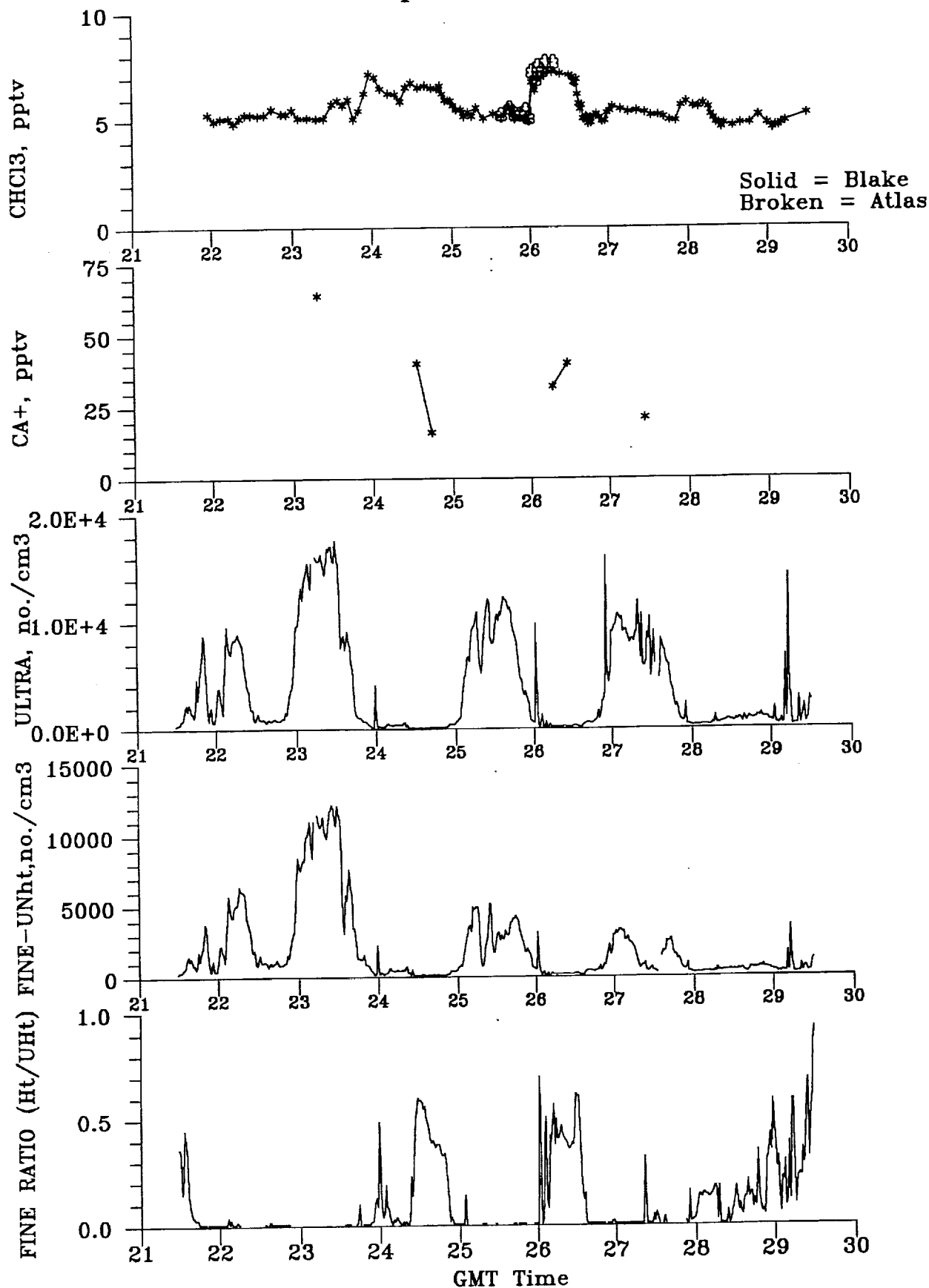
PEM Tropics B; DC-8; FLIGHT 12



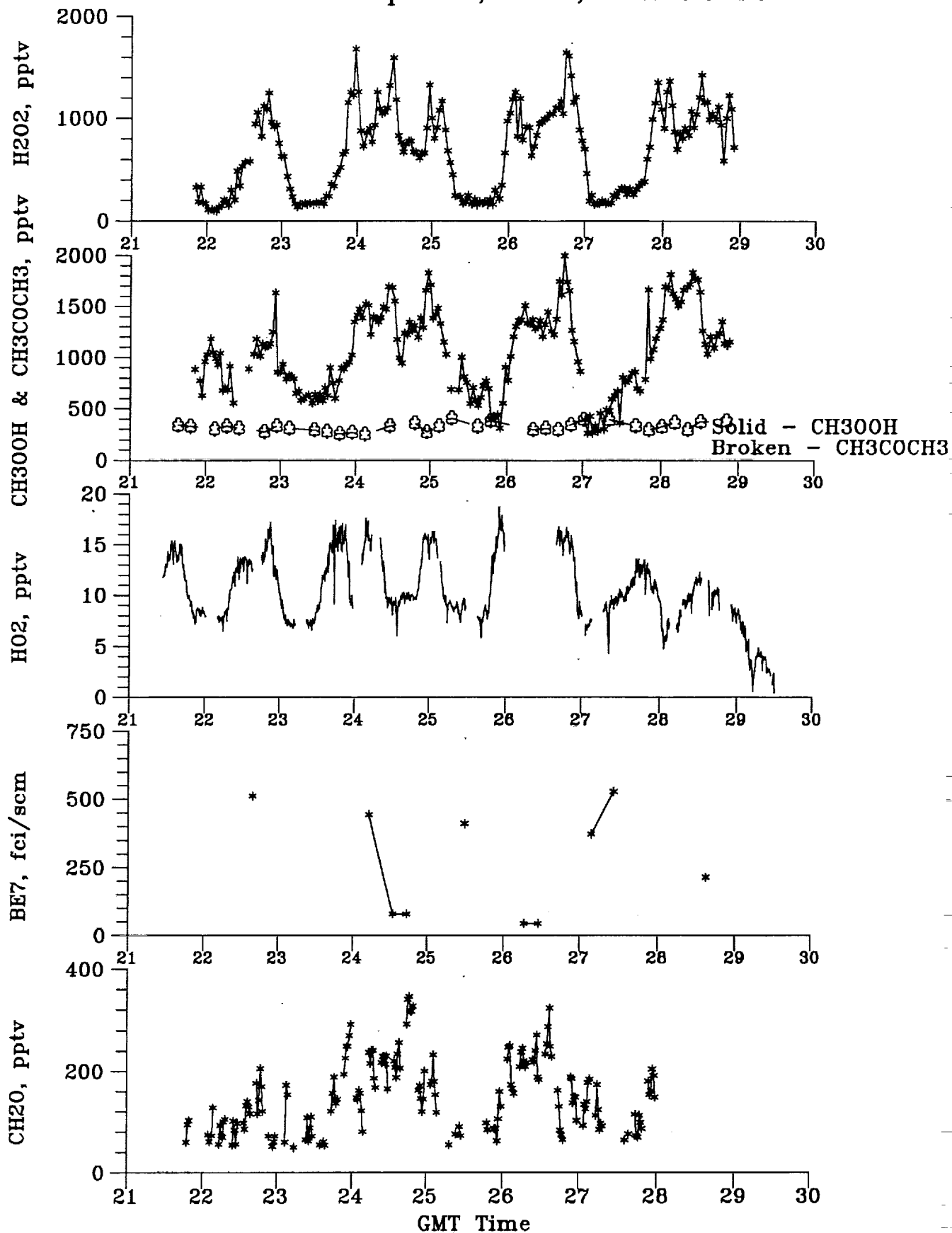
PEM Tropics B; DC-8; FLIGHT 12



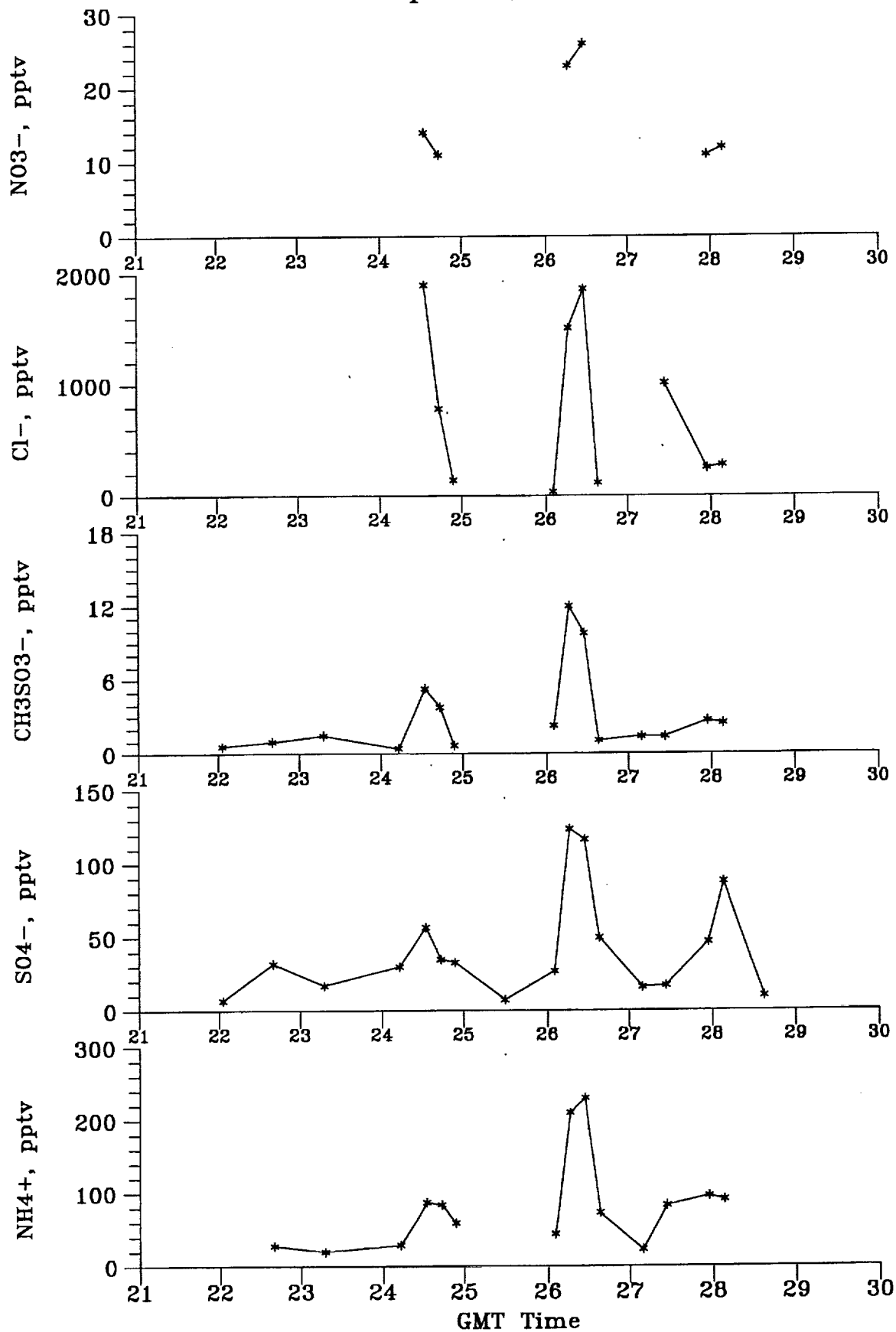
PEM Tropics B; DC-8; FLIGHT 12



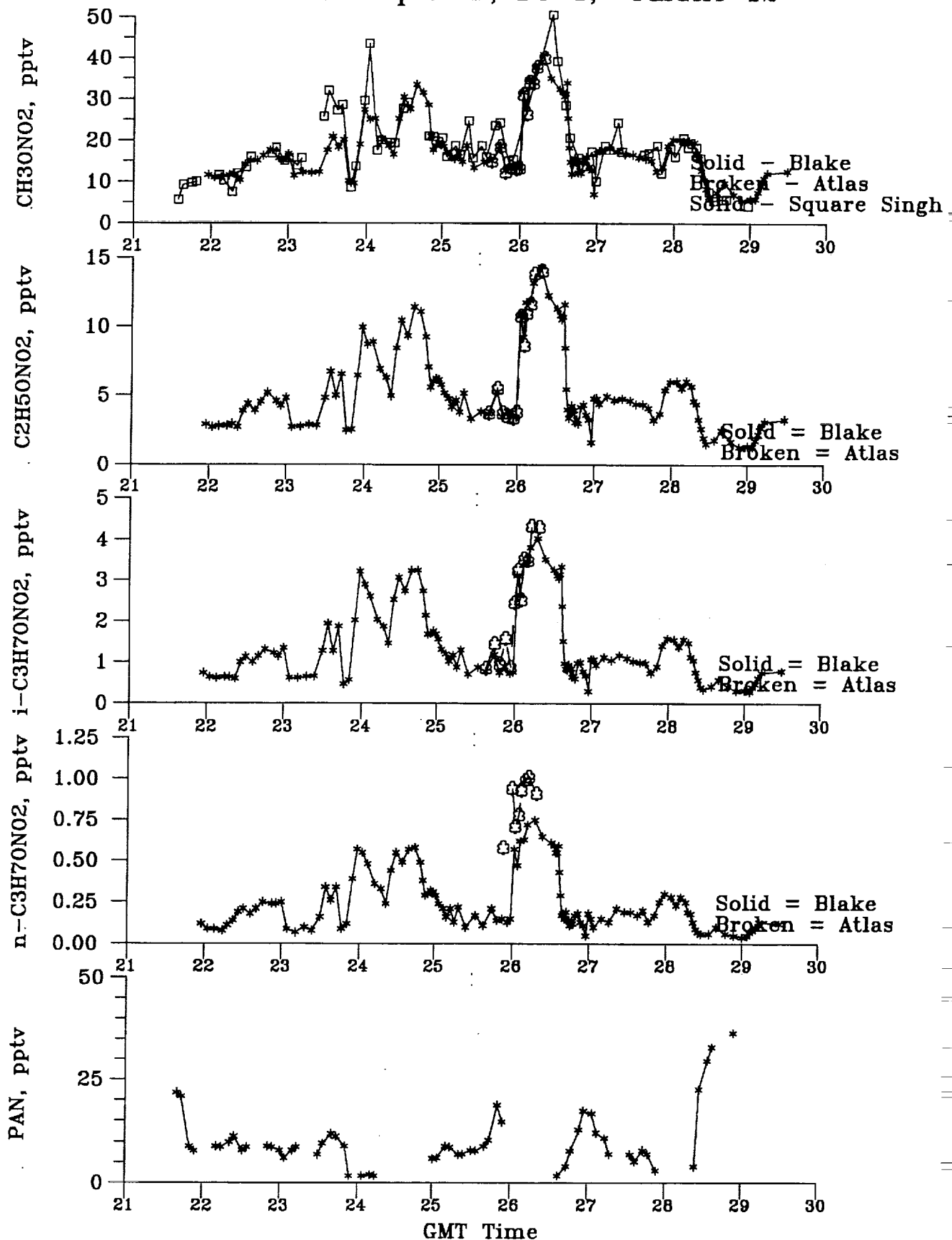
PEM Tropics B; DC-8; FLIGHT 12



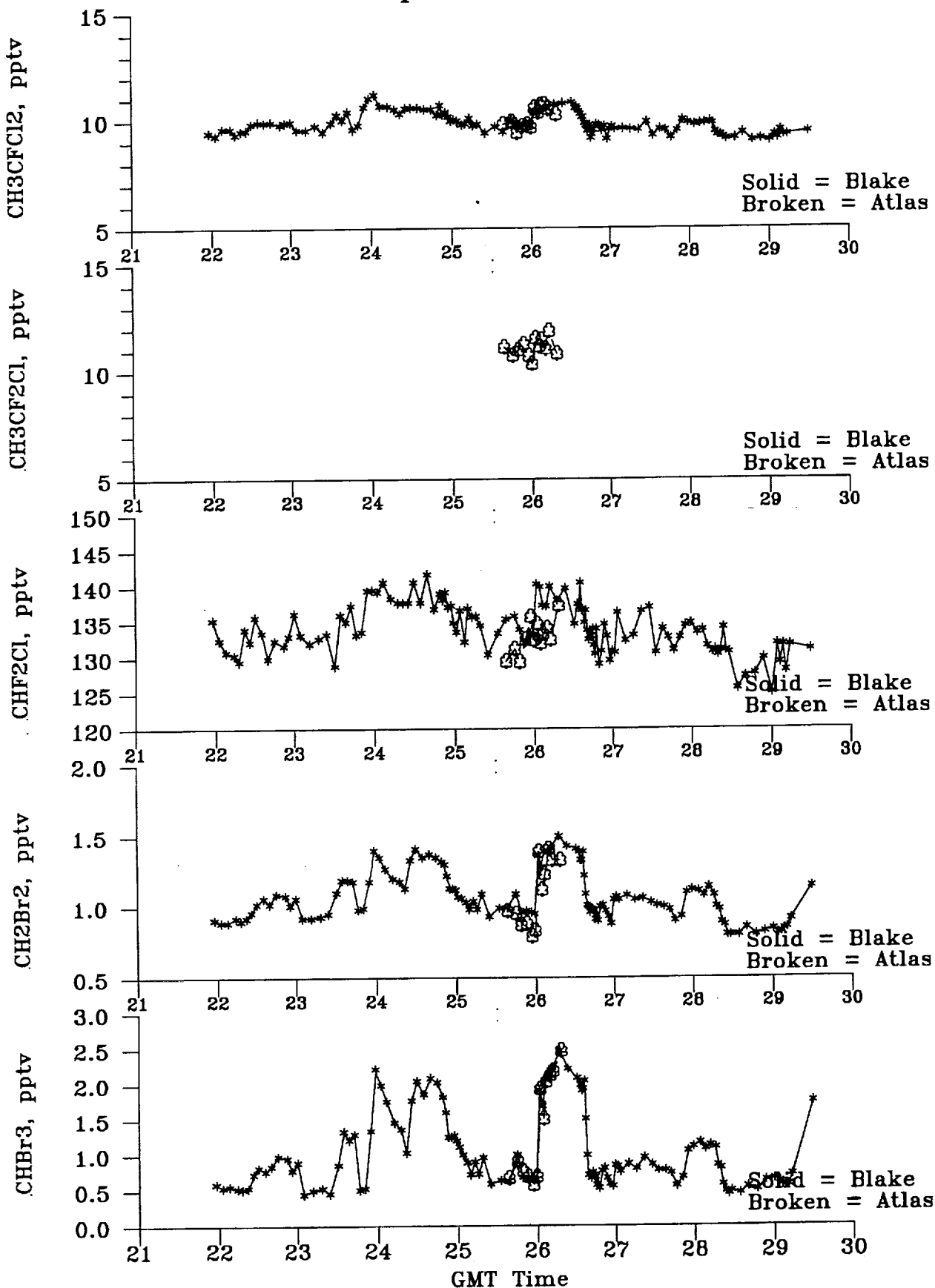
PEM Tropics B; DC-8; FLIGHT 12



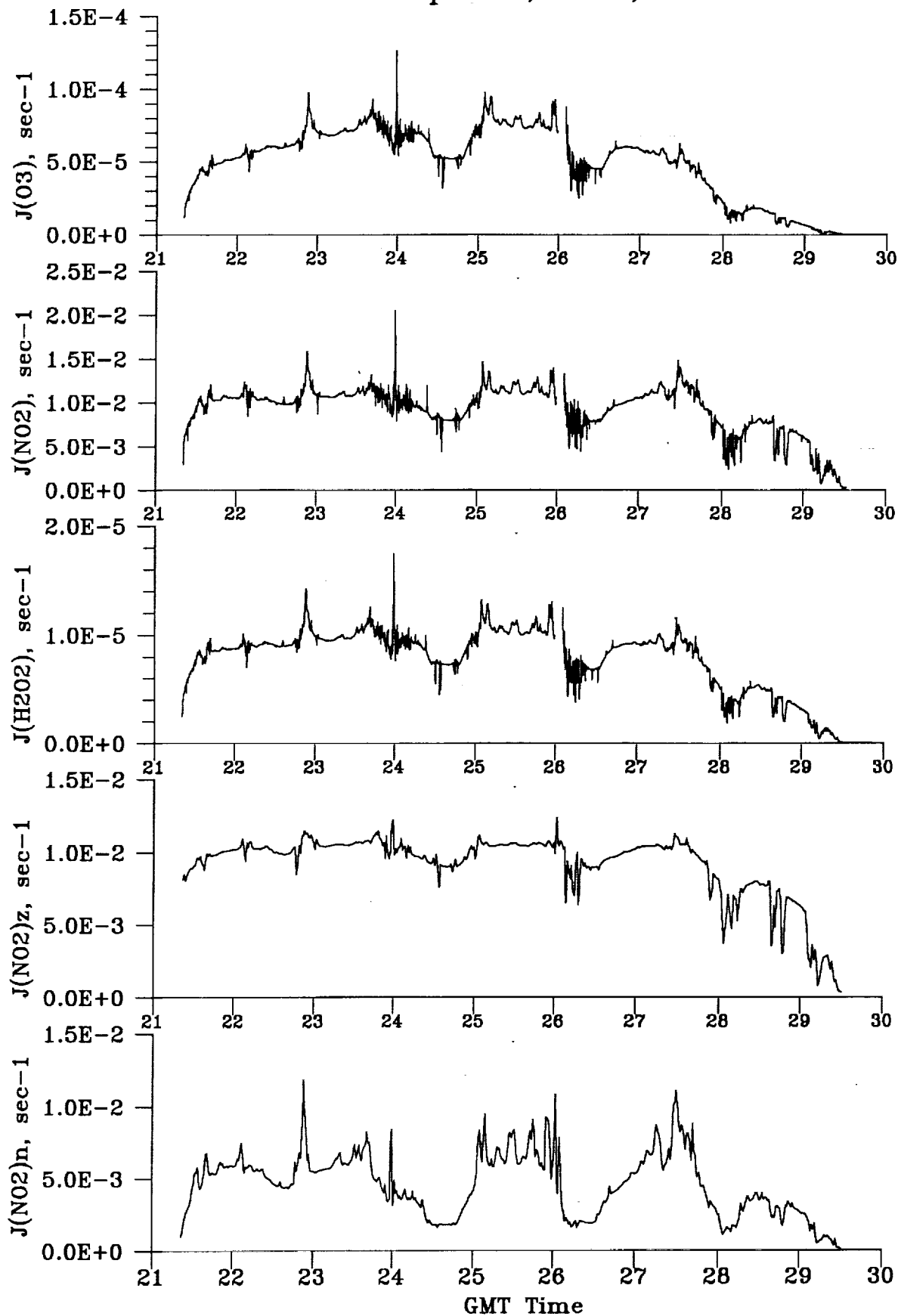
PEM Tropics B; DC-8; FLIGHT 12



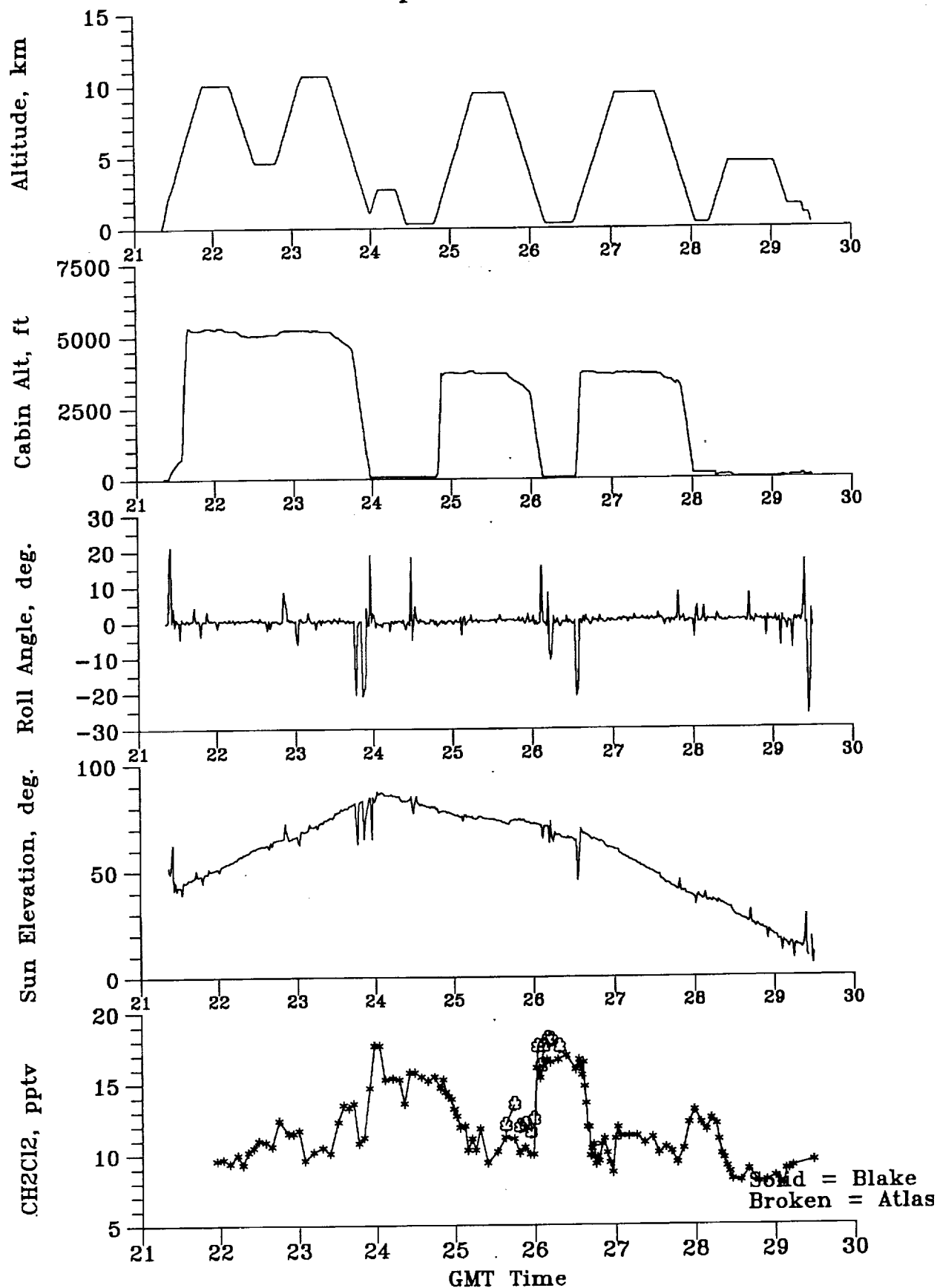
PEM Tropics B; DC-8; FLIGHT 12



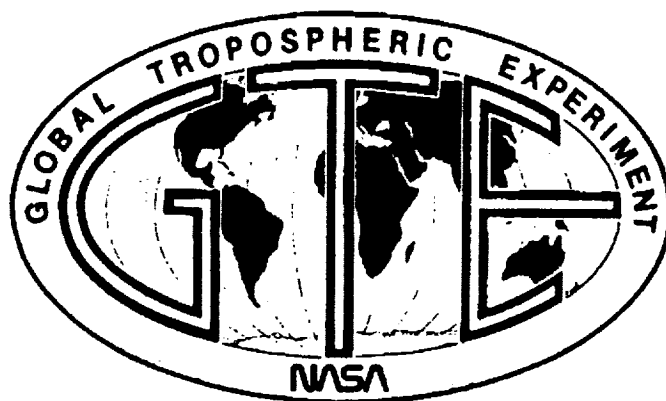
PEM Tropics B; DC-8; FLIGHT 12



PEM Tropics B; DC-8; FLIGHT 12



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

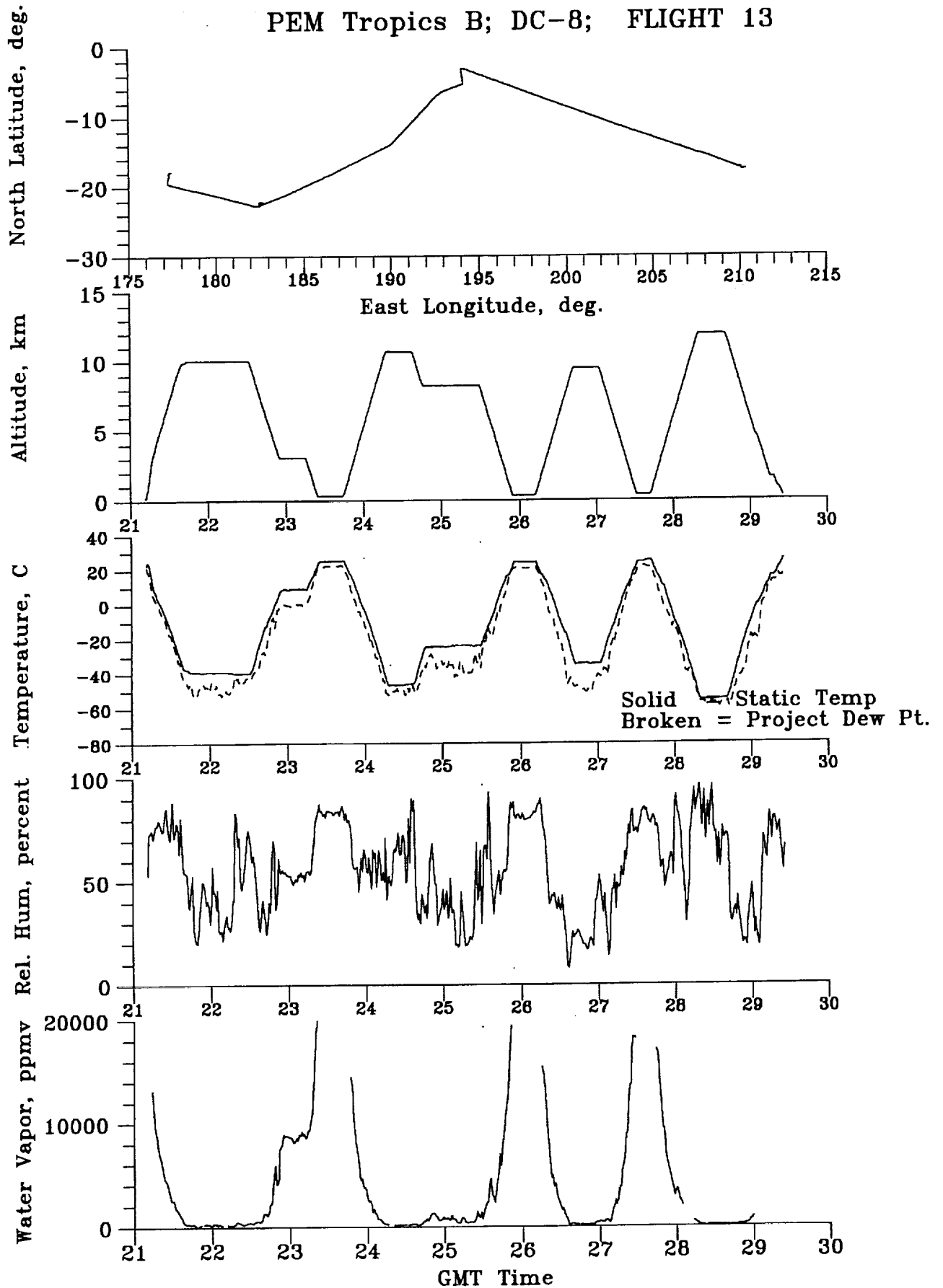
Flight 13D

Transit: Fiji to Tahiti

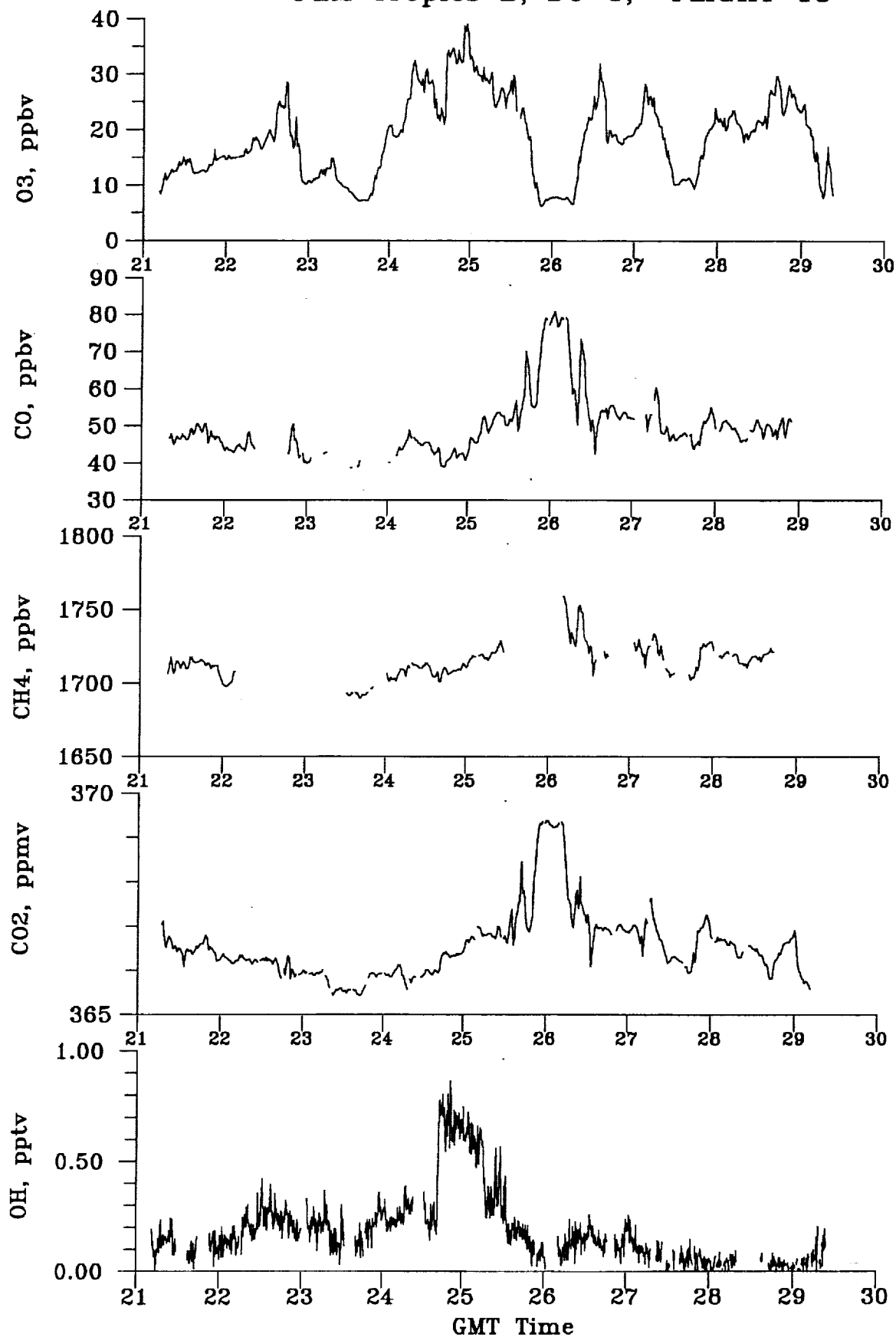
Equatorial Survey

March 26, 1999

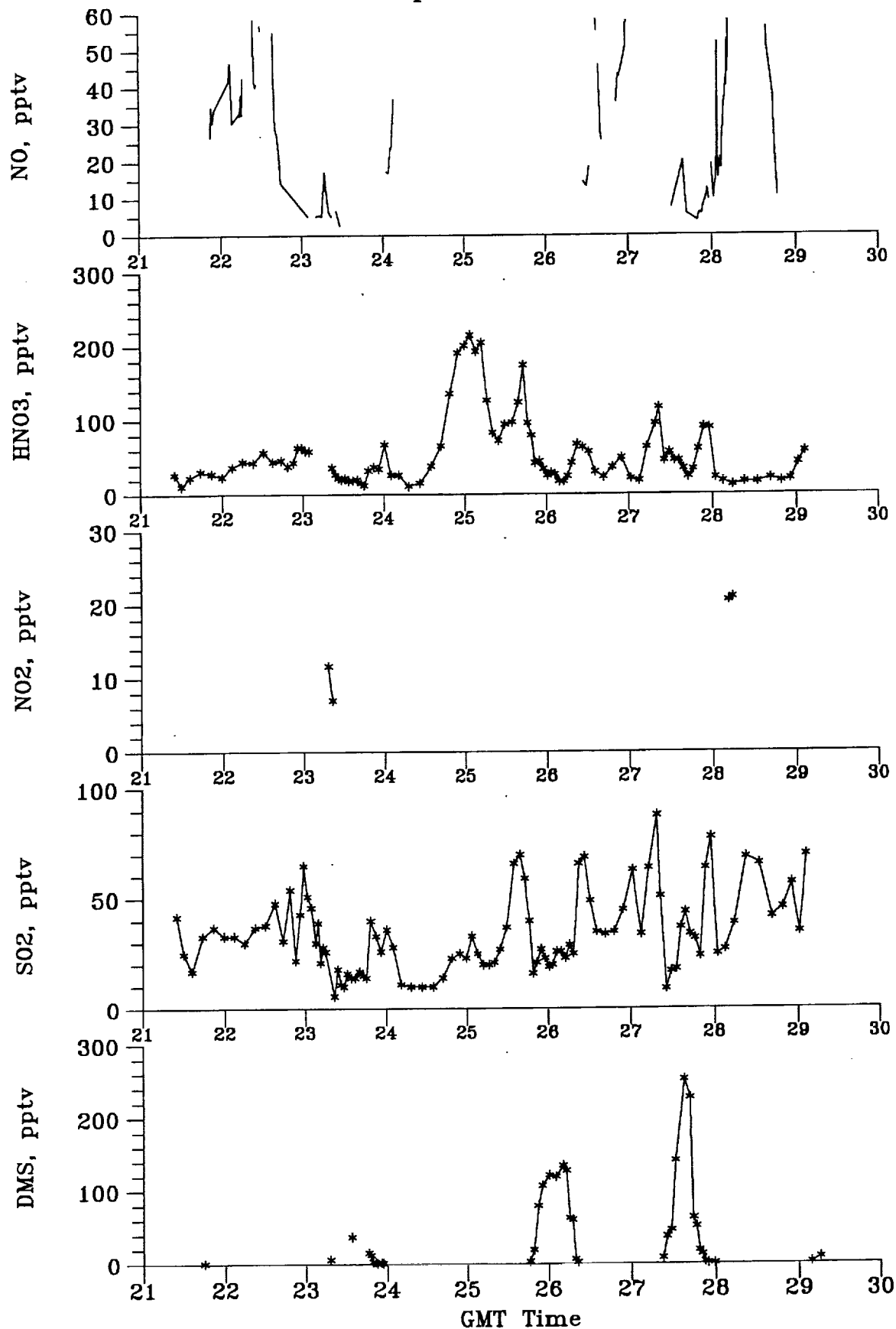
PEM Tropics B; DC-8; FLIGHT 13



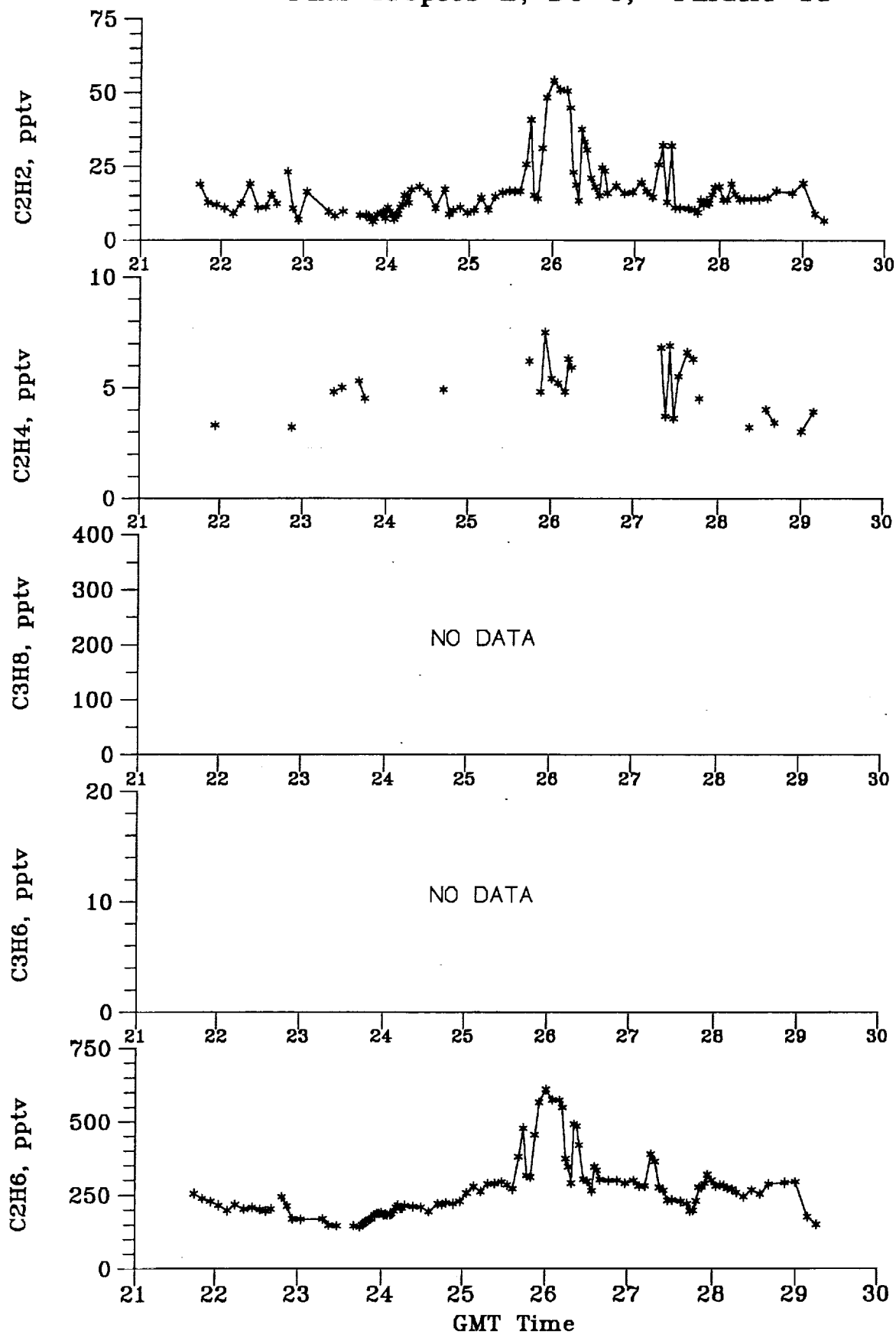
PEM Tropics B; DC-8; FLIGHT 13



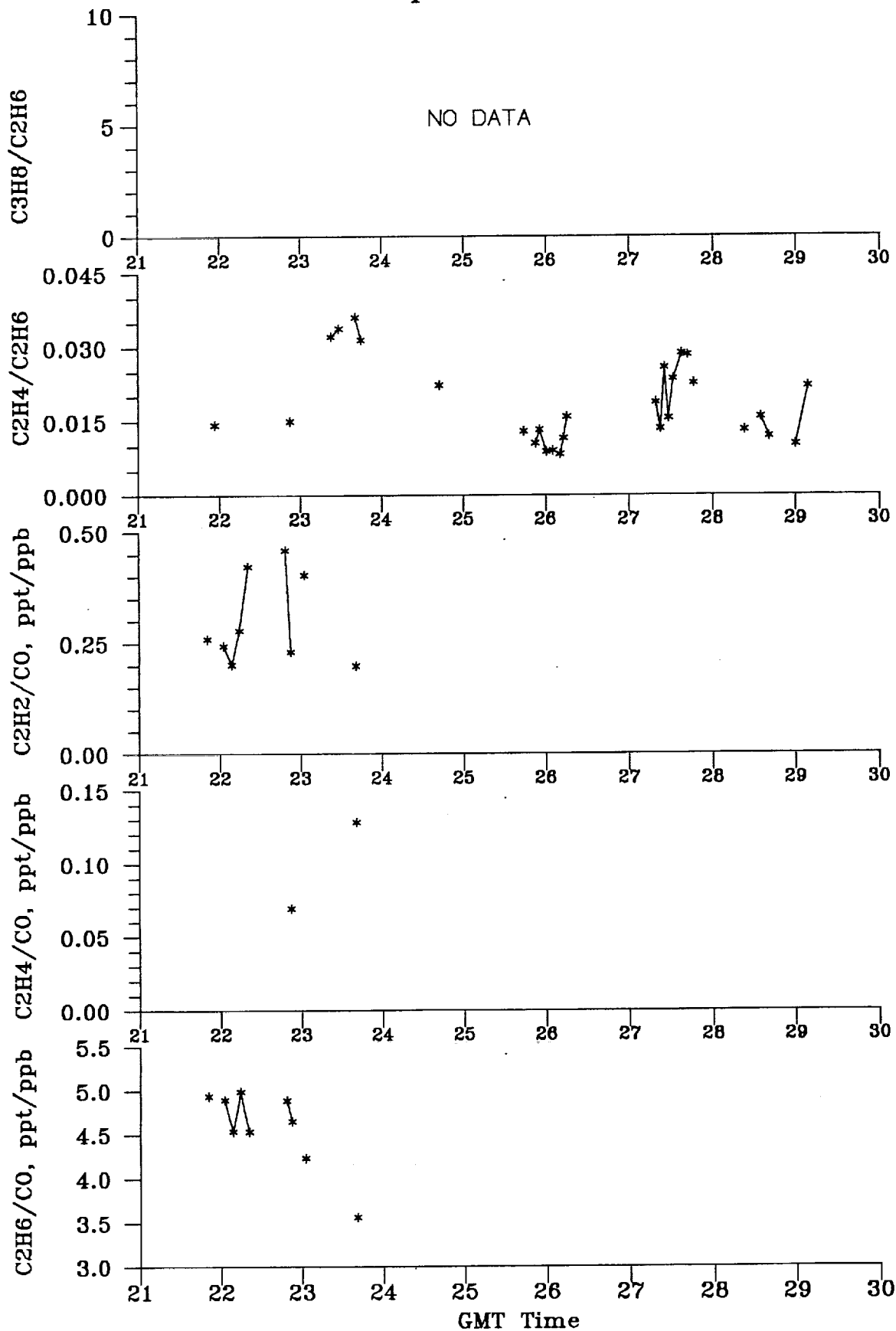
PEM Tropics B; DC-8; FLIGHT 13



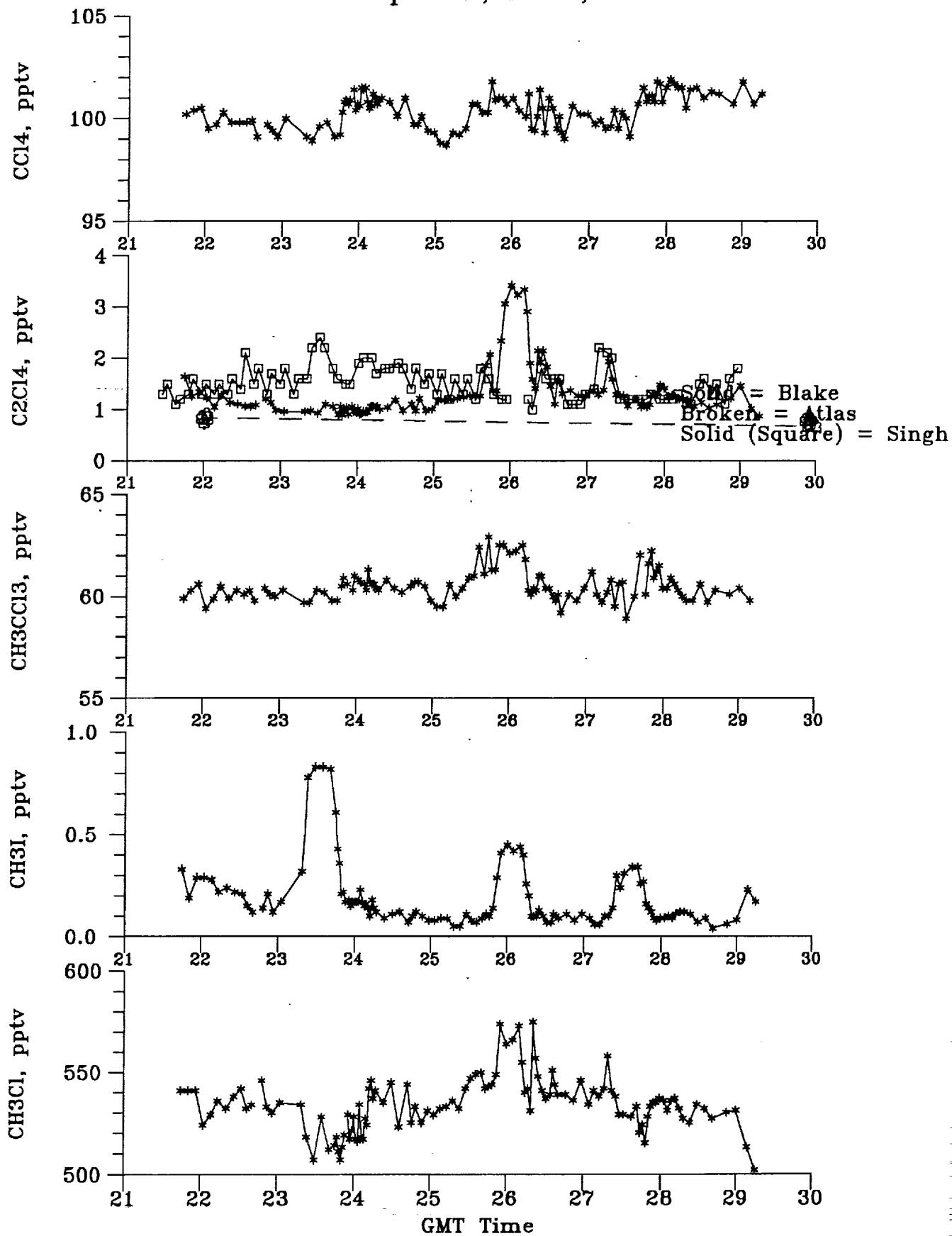
PEM Tropics B; DC-8; FLIGHT 13



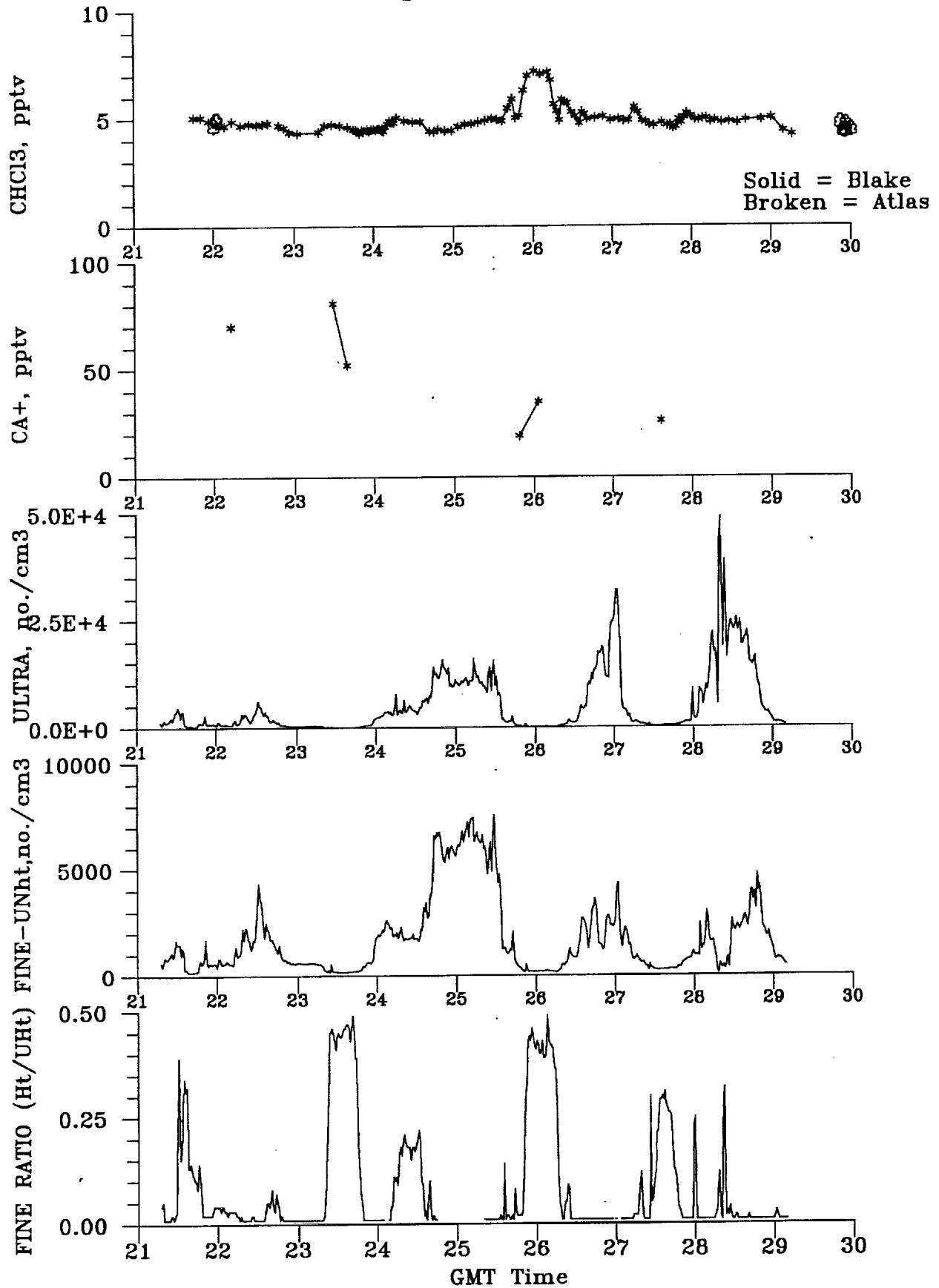
PEM Tropics B; DC-8; FLIGHT 13



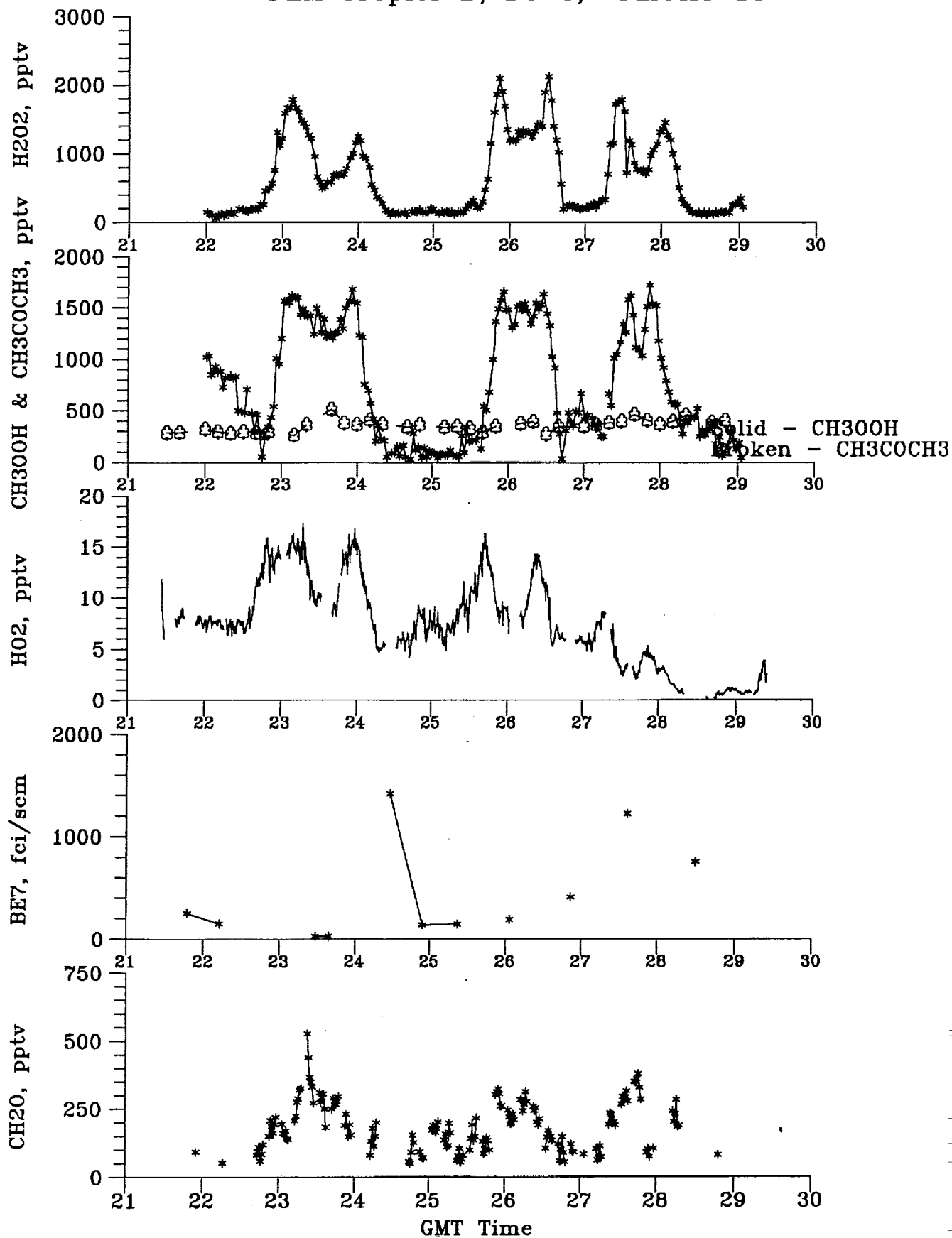
PEM Tropics B; DC-8; FLIGHT 13



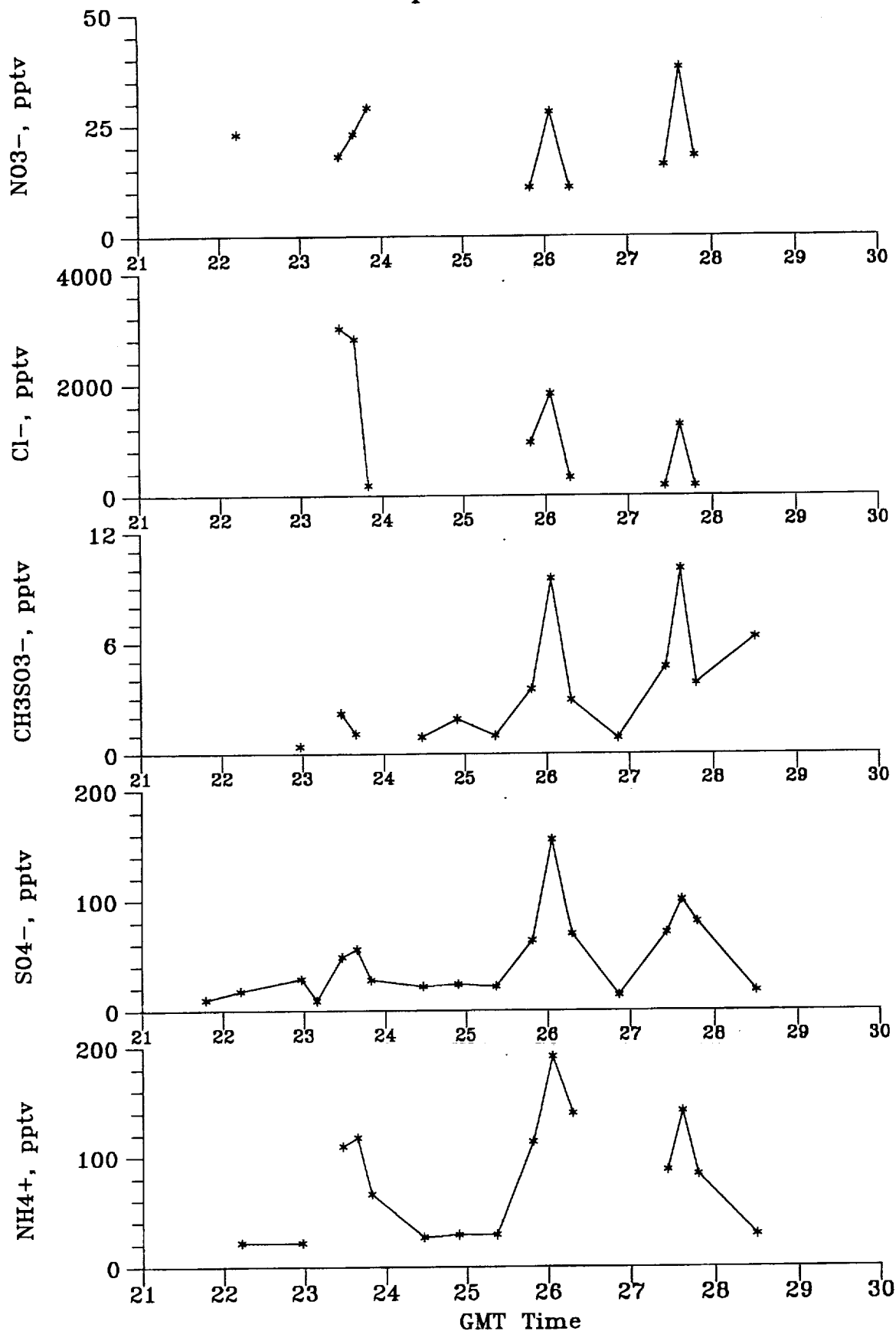
PEM Tropics B; DC-8; FLIGHT 13



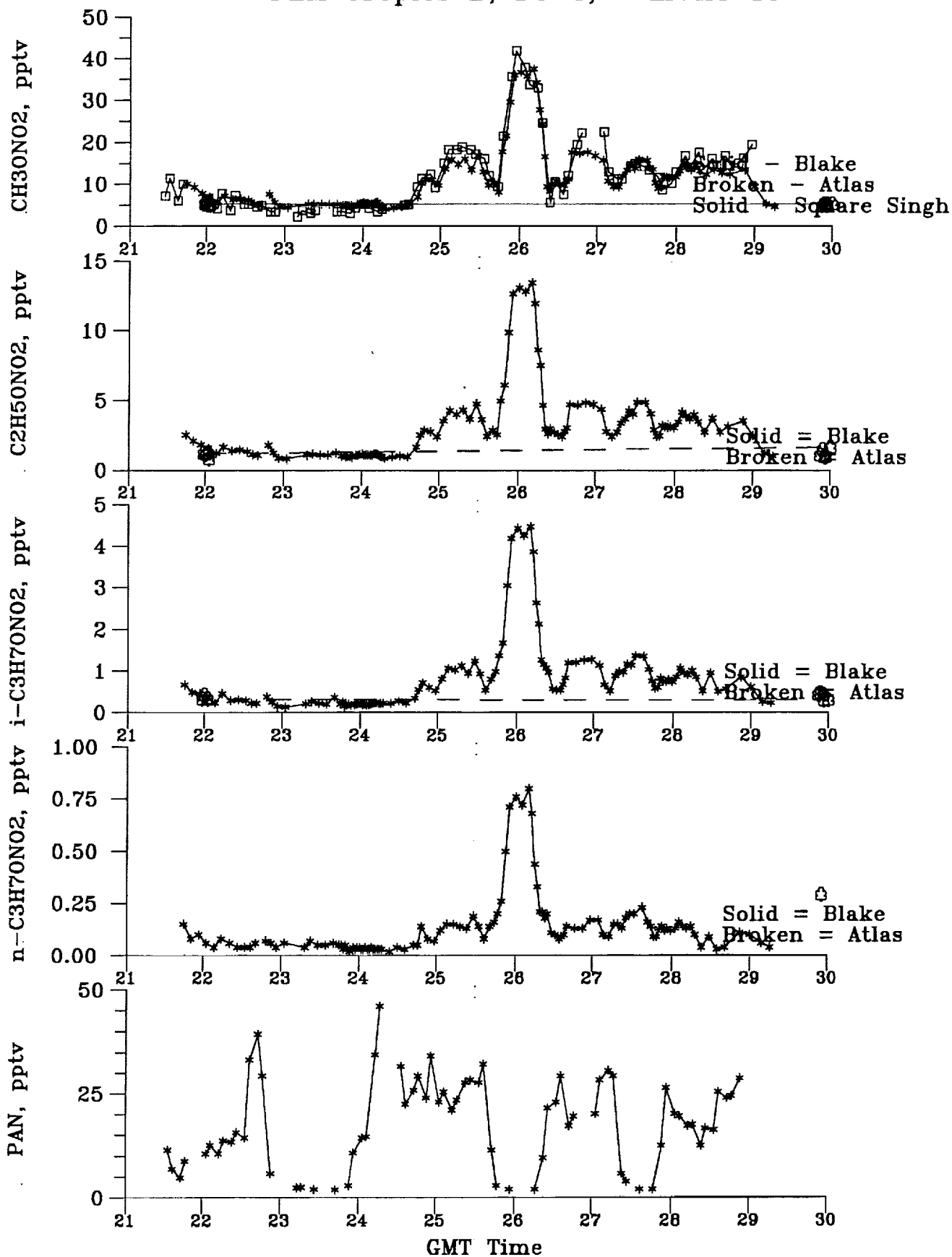
PEM Tropics B; DC-8; FLIGHT 13



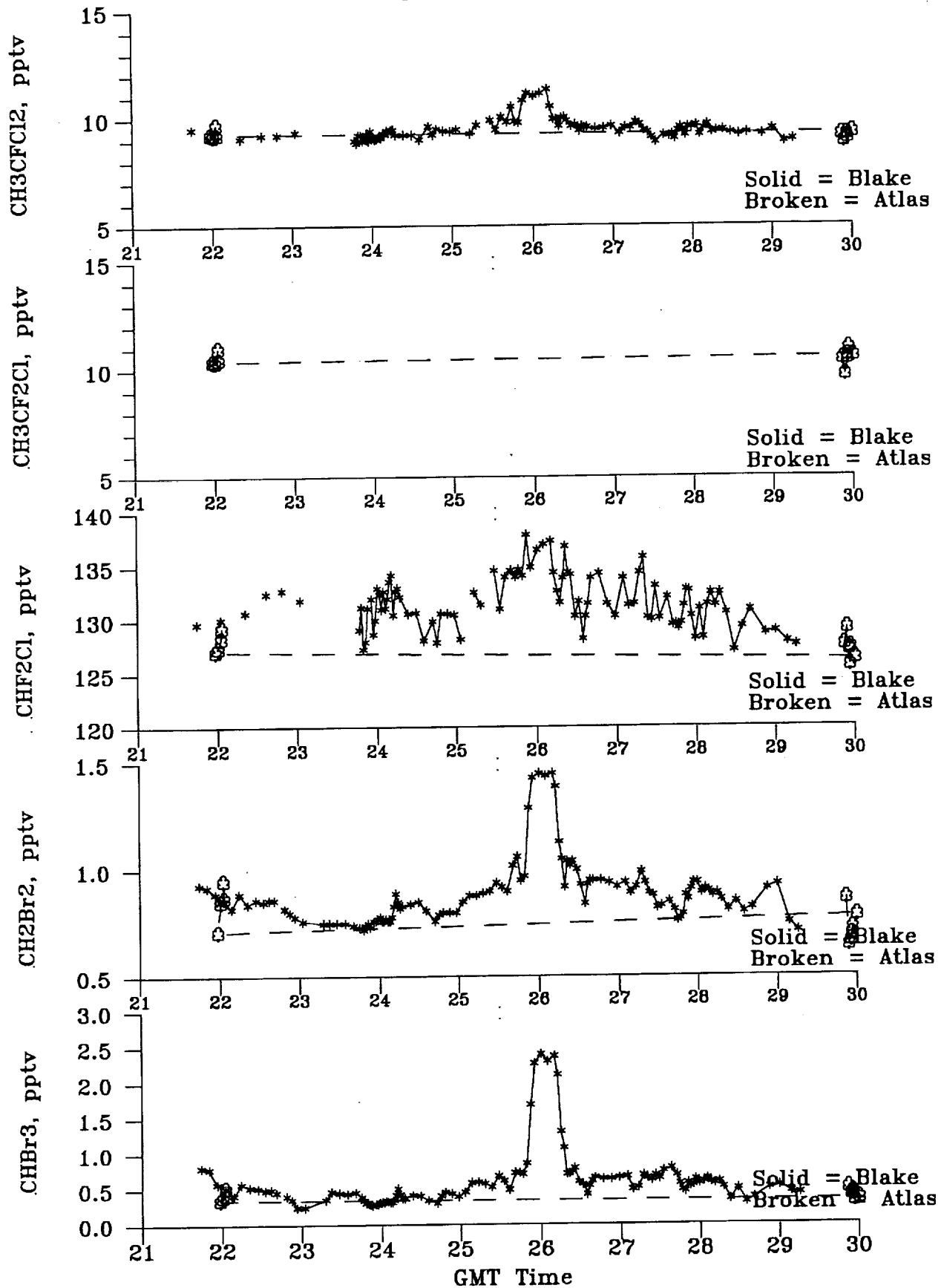
PEM Tropics B; DC-8; FLIGHT 13



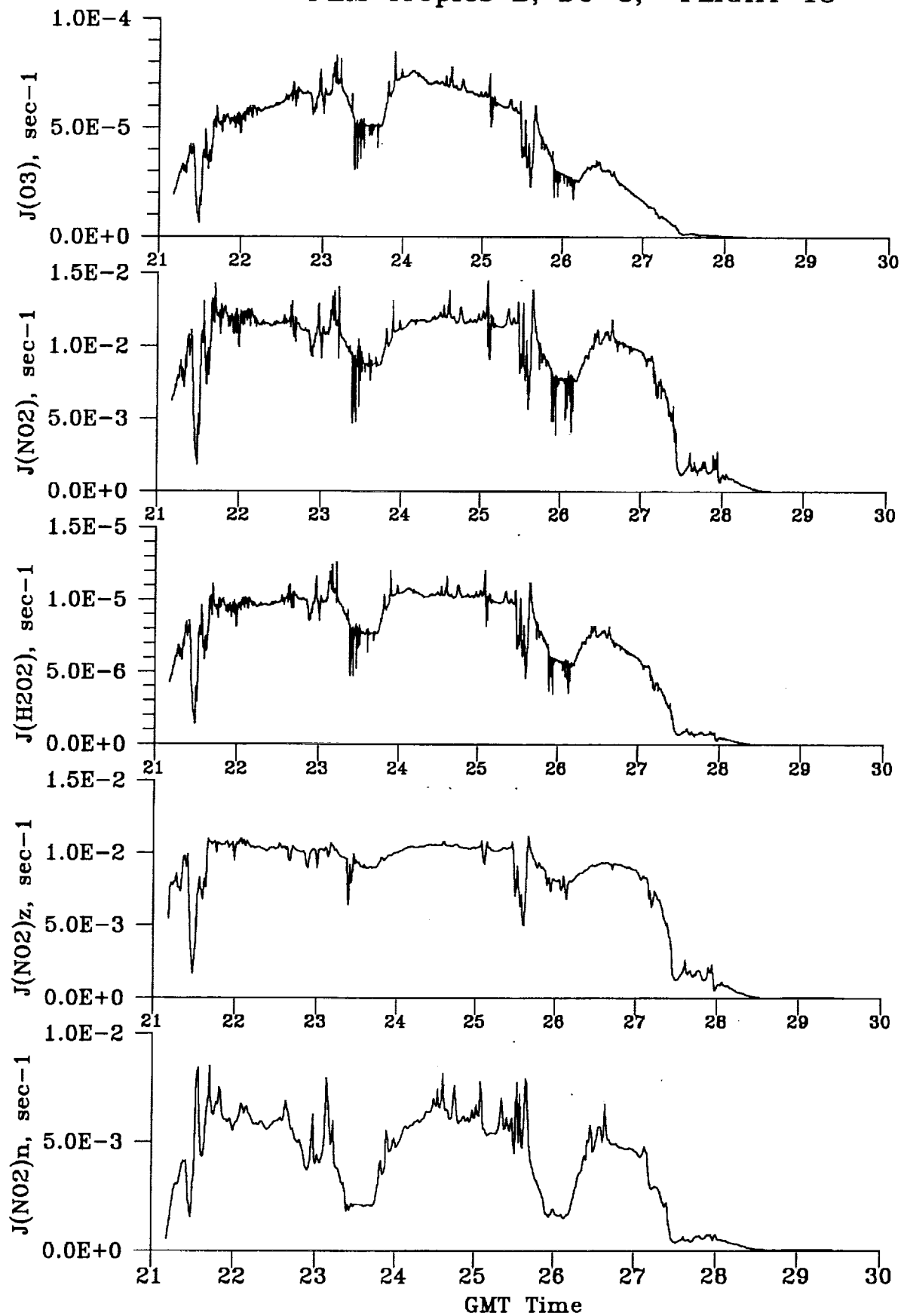
PEM Tropics B; DC-8; FLIGHT 13



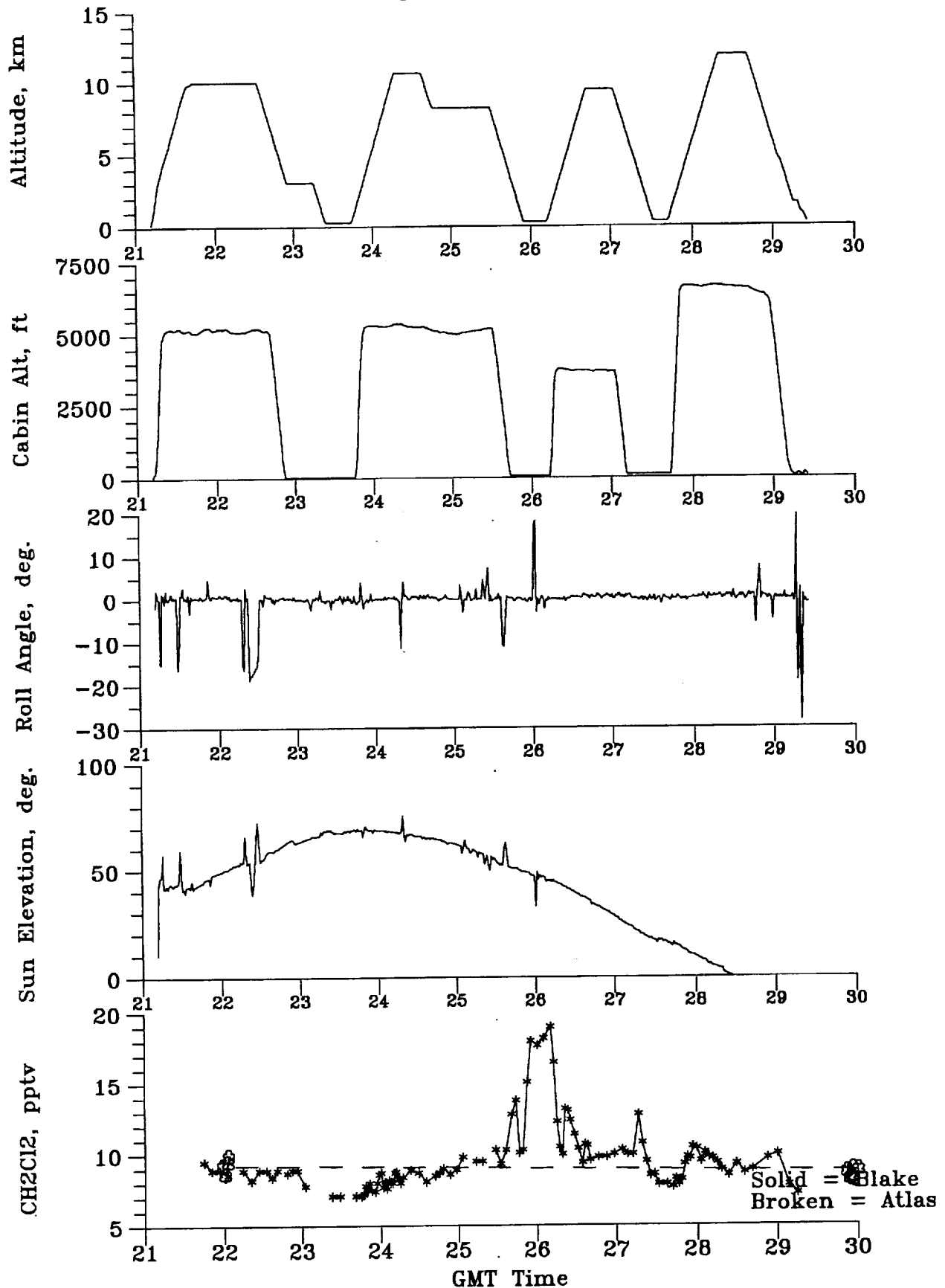
PEM Tropics B; DC-8; FLIGHT 13



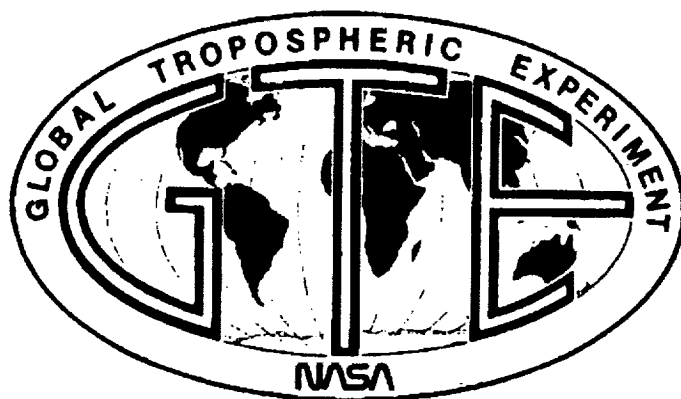
PEM Tropics B; DC-8; FLIGHT 13



PEM Tropics B; DC-8; FLIGHT 13



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

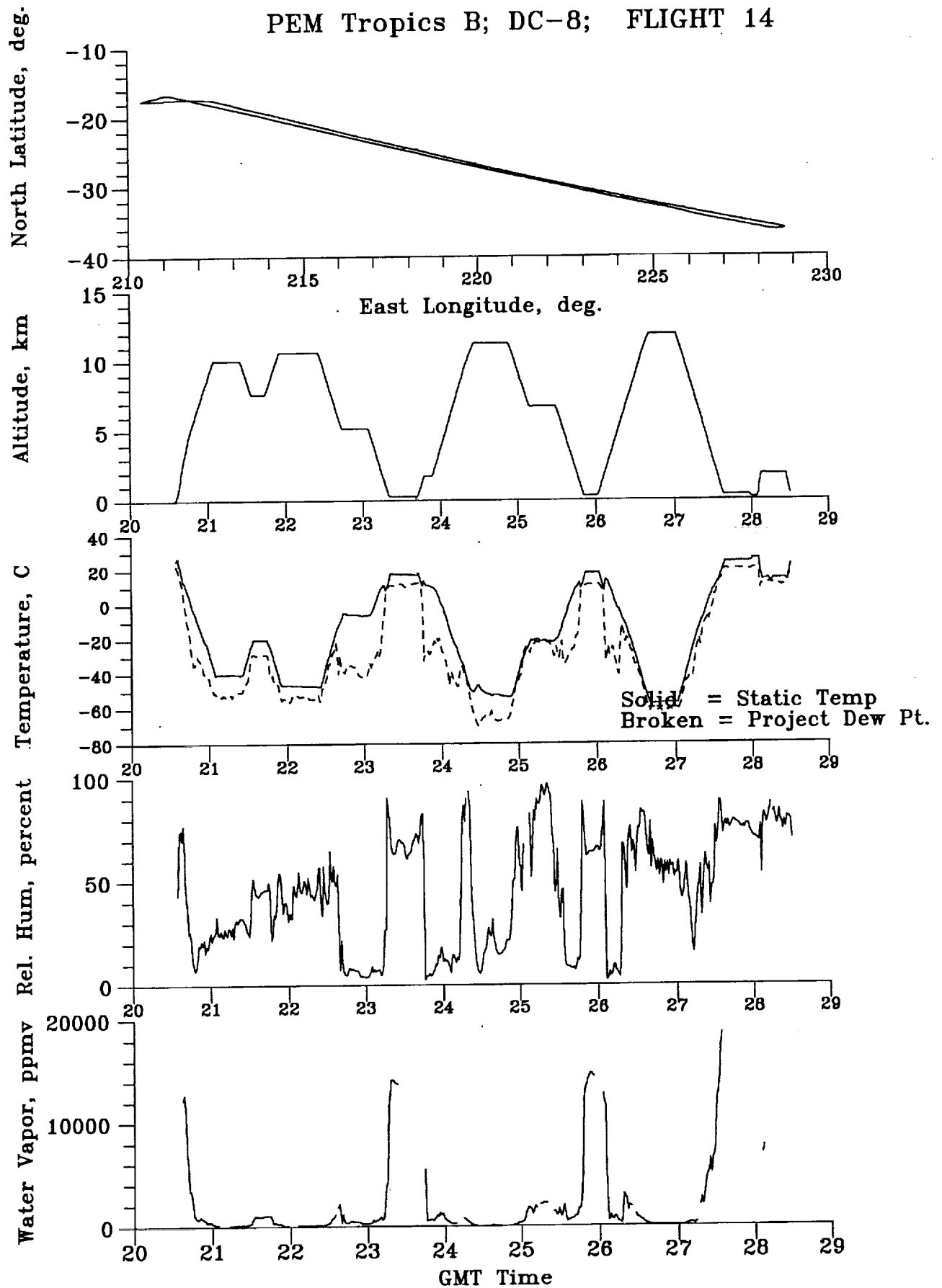
Flight 14D

Local: Tahiti No. 1

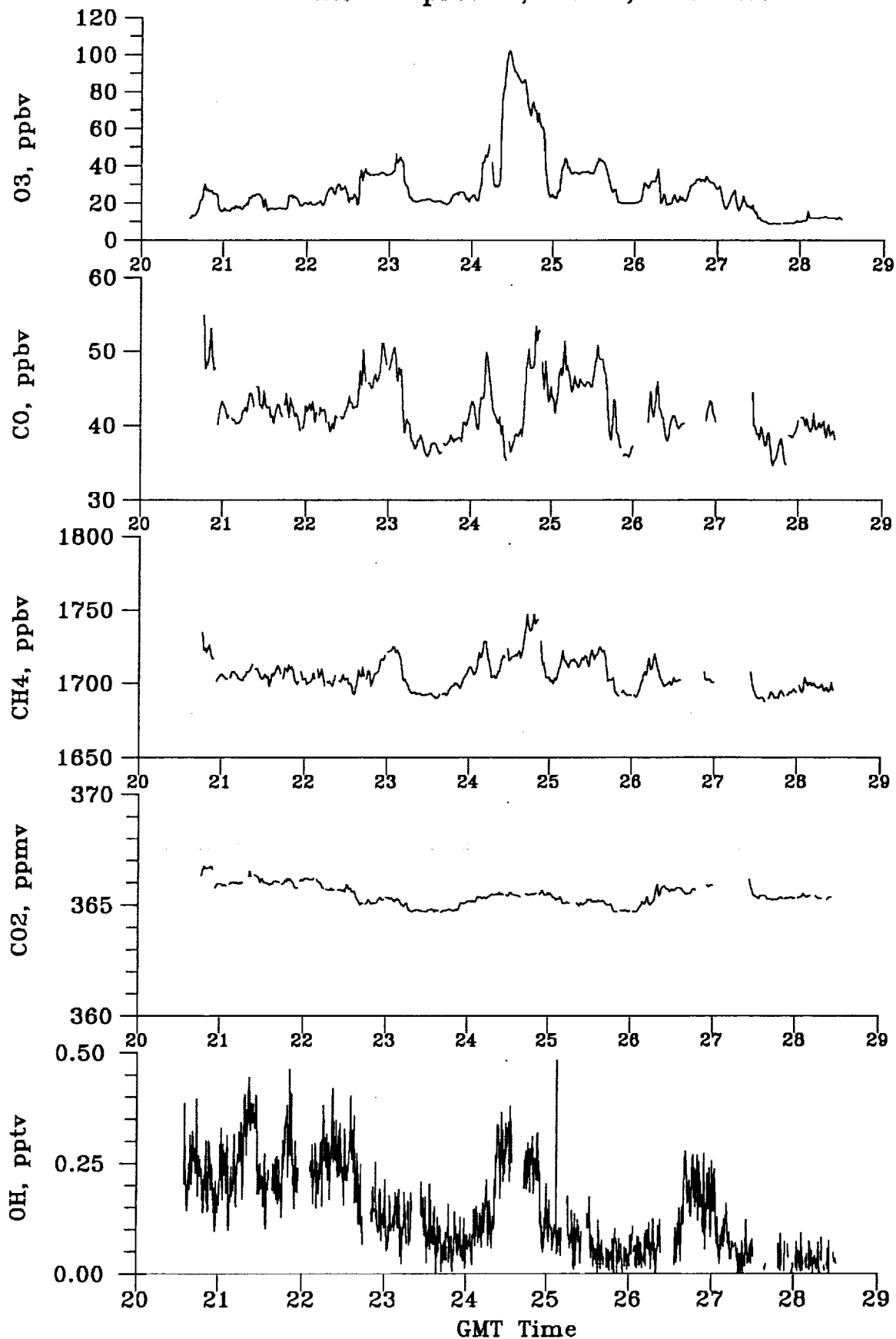
Southern Latitudes Characterization

March 30, 1999

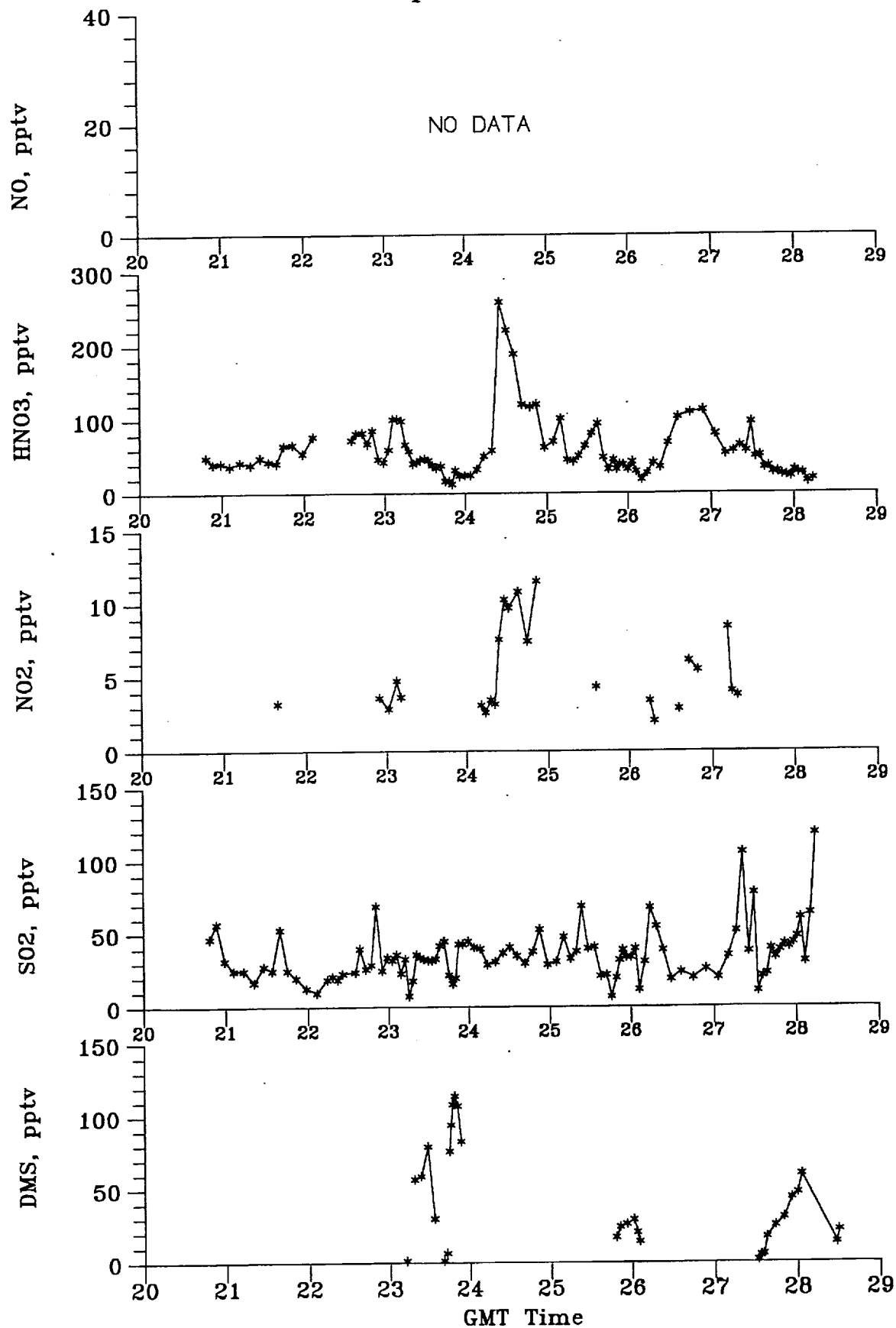
PEM Tropics B; DC-8; FLIGHT 14



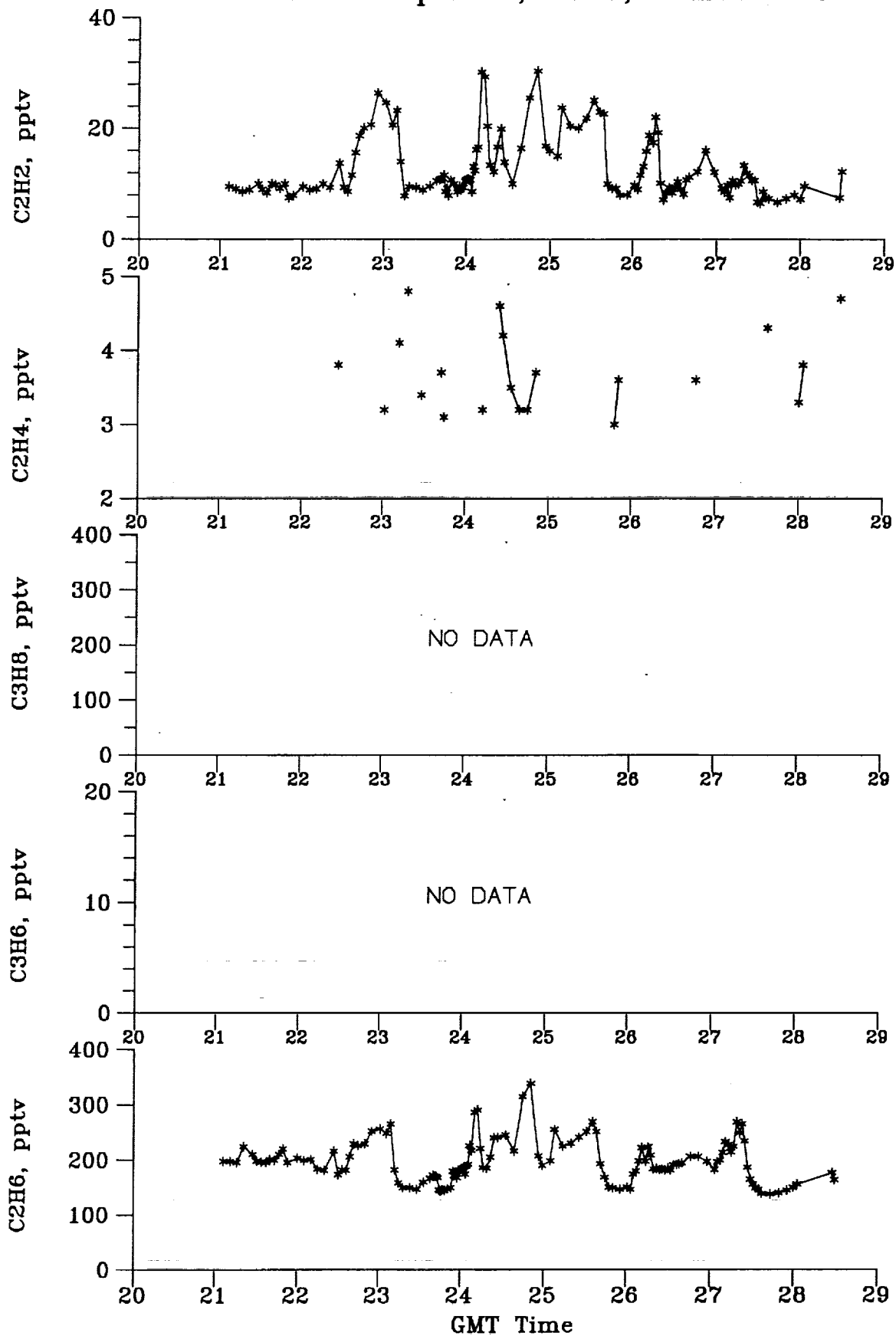
PEM Tropics B; DC-8; FLIGHT 14



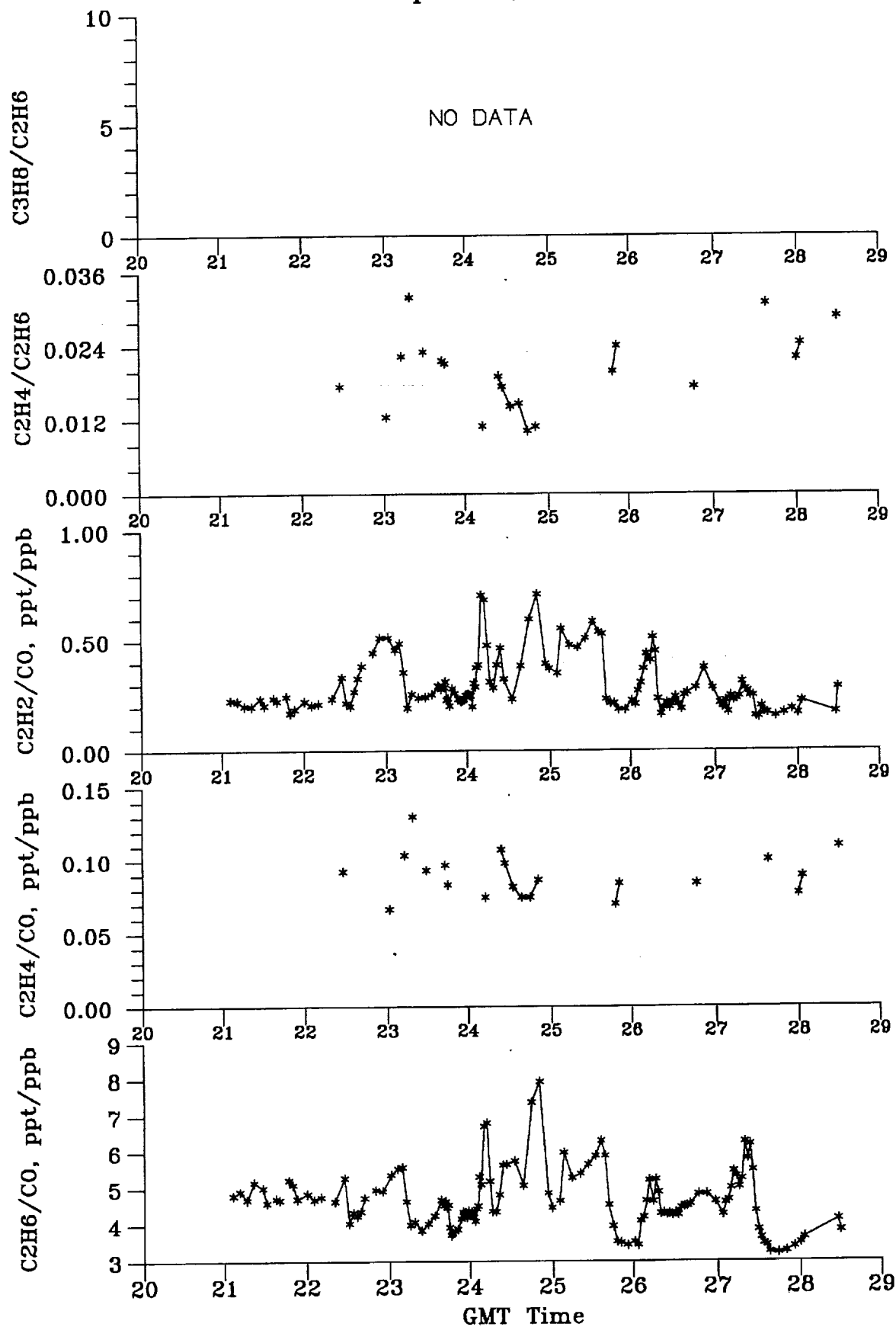
PEM Tropics B; DC-8; FLIGHT 14



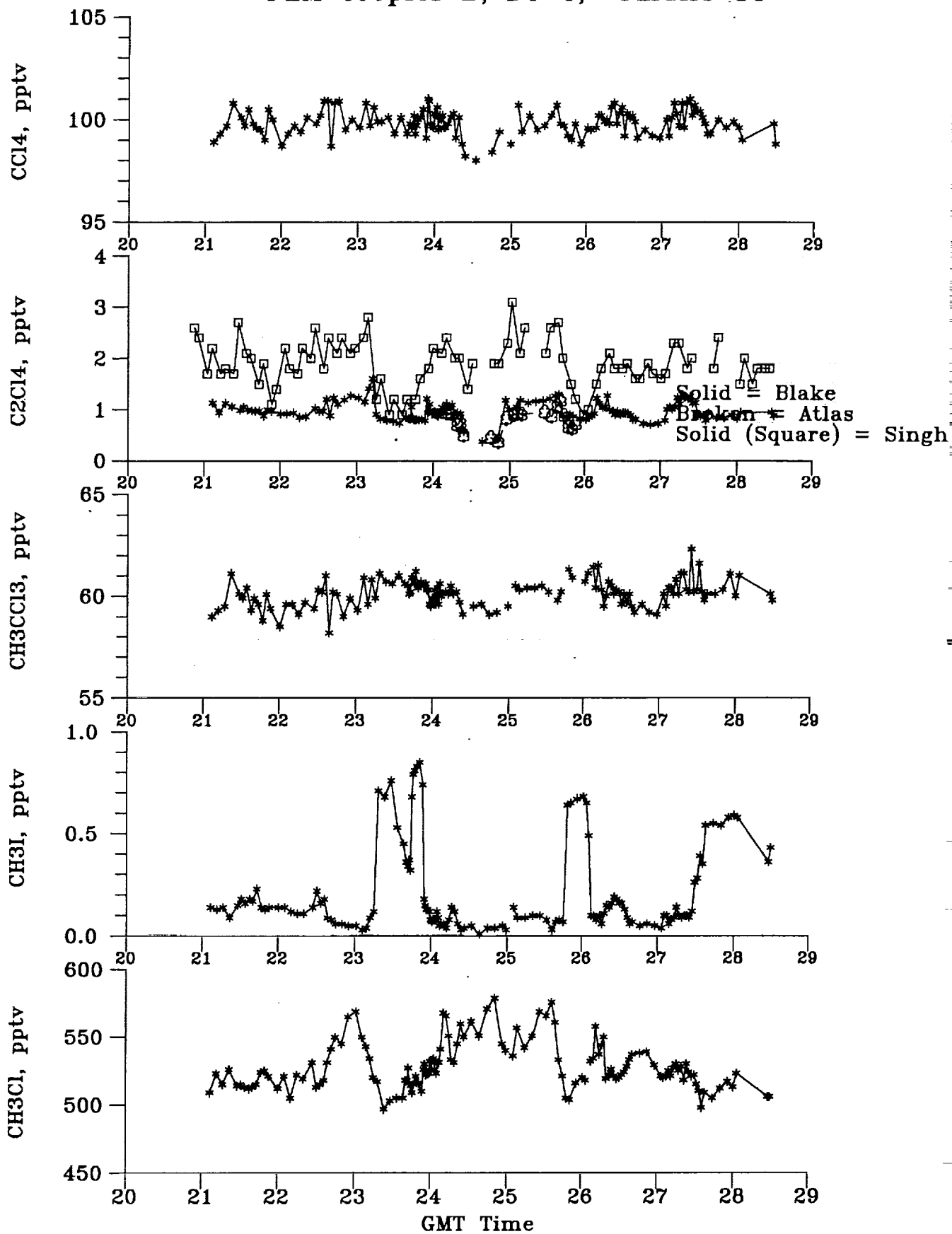
PEM Tropics B; DC-8; FLIGHT 14



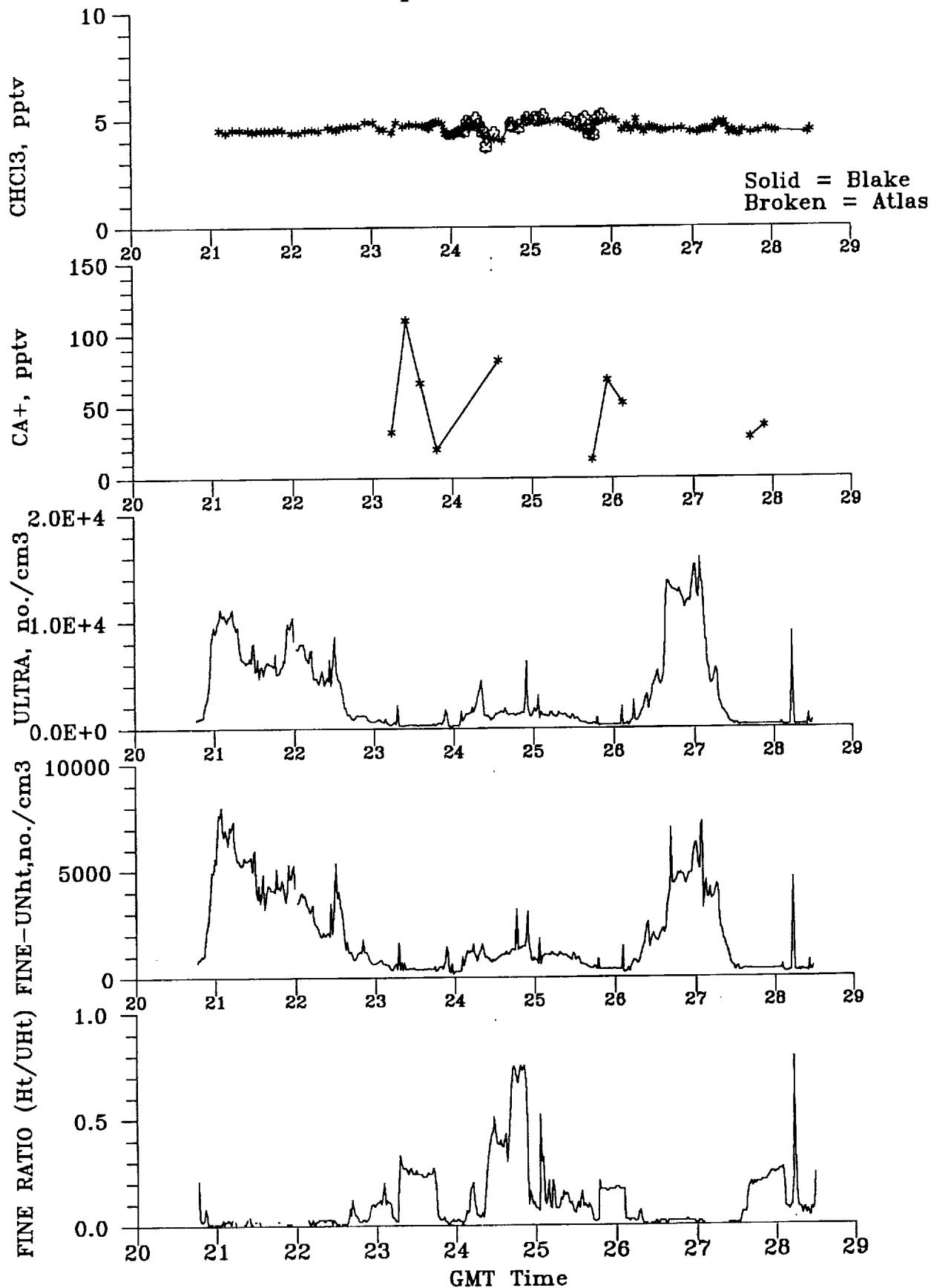
PEM Tropics B; DC-8; FLIGHT 14



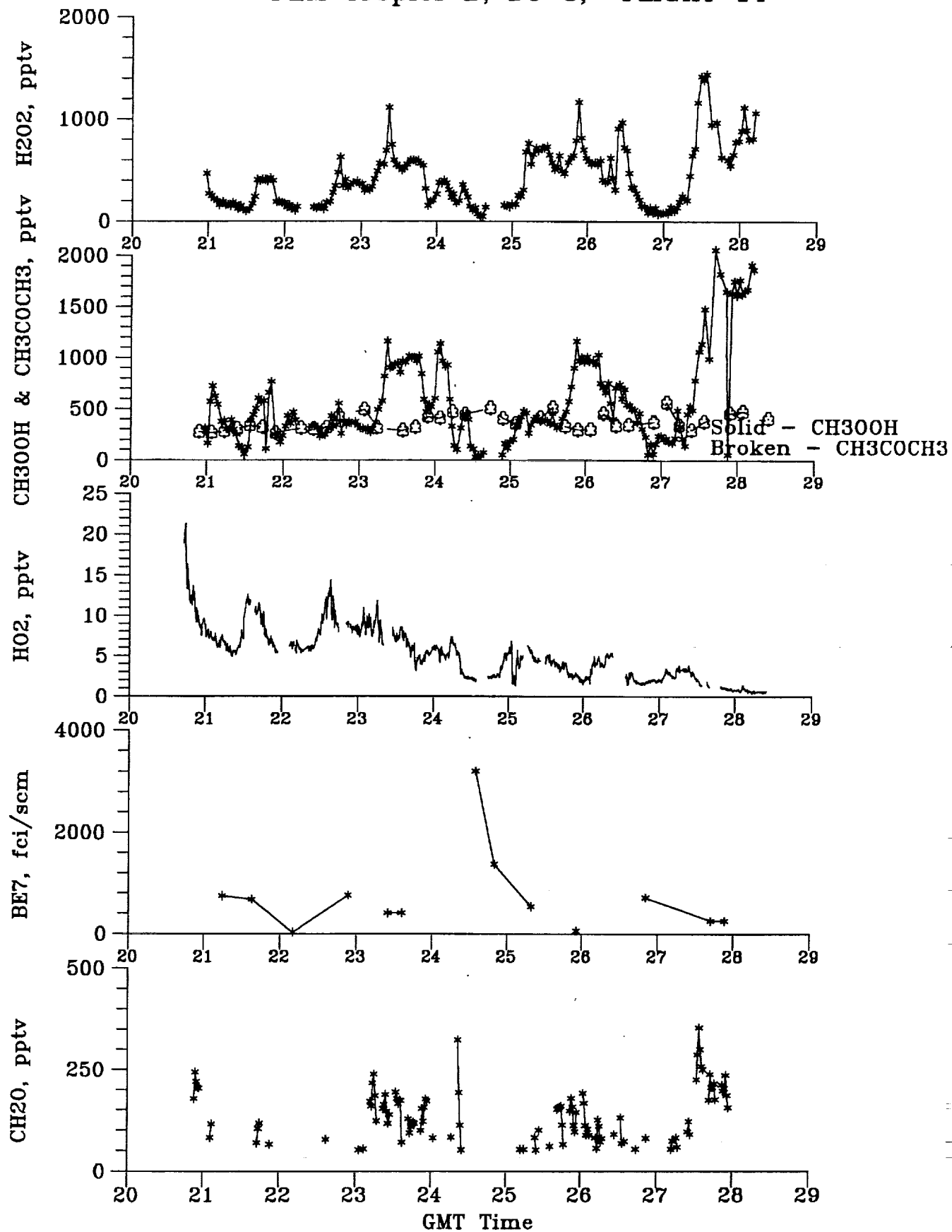
PEM Tropics B; DC-8; FLIGHT 14



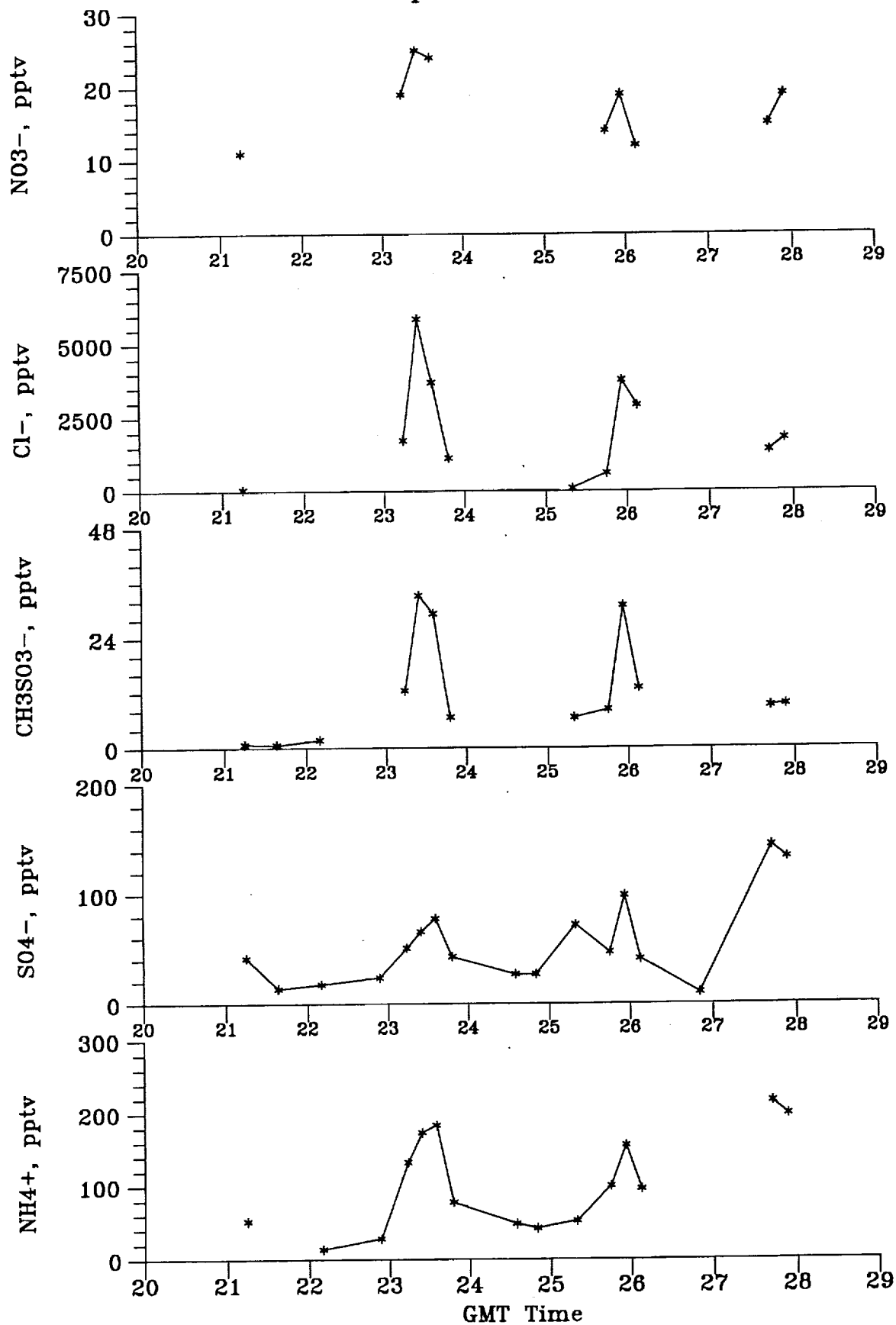
PEM Tropics B; DC-8; FLIGHT 14



PEM Tropics B; DC-8; FLIGHT 14

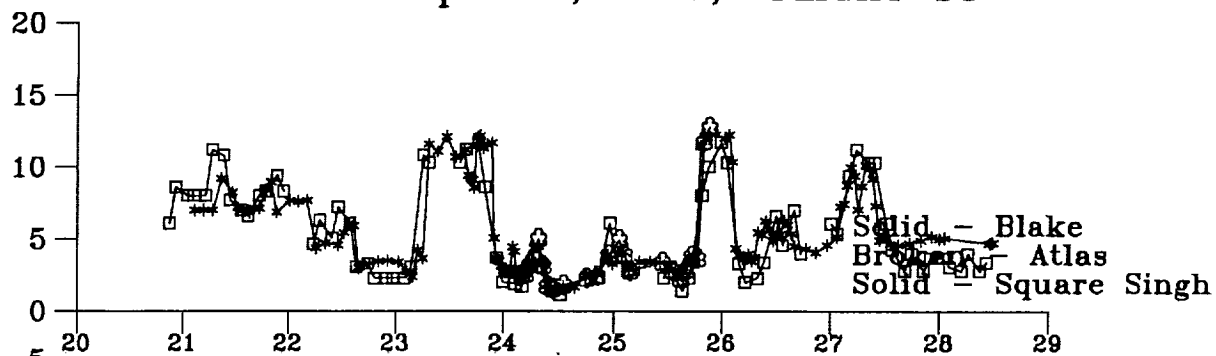


PEM Tropics B; DC-8; FLIGHT 14

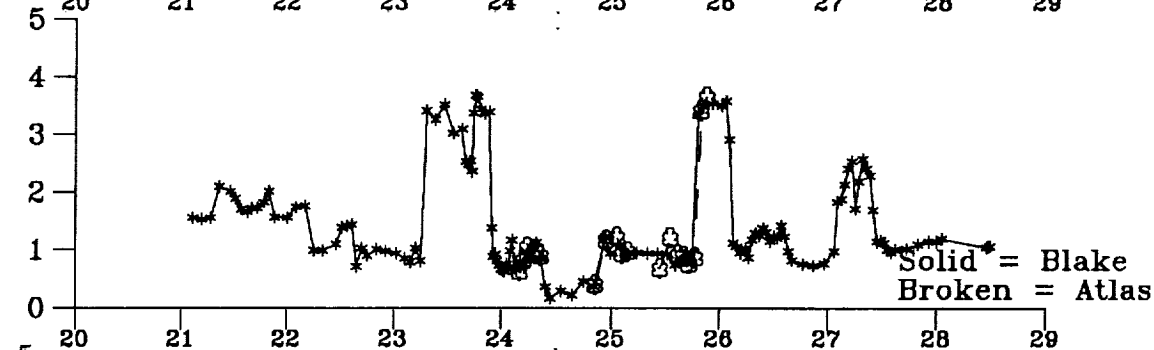


PEM Tropics B; DC-8; FLIGHT 14

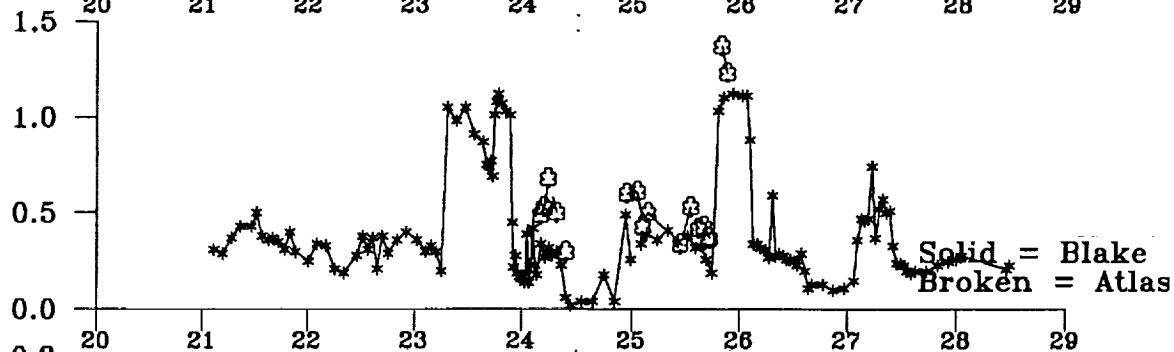
CH3ONO2, pptv



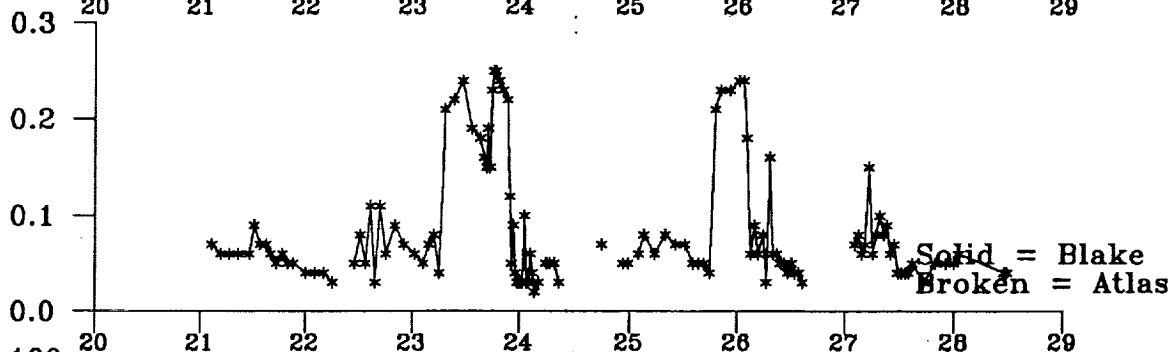
C2H5ONO2, pptv



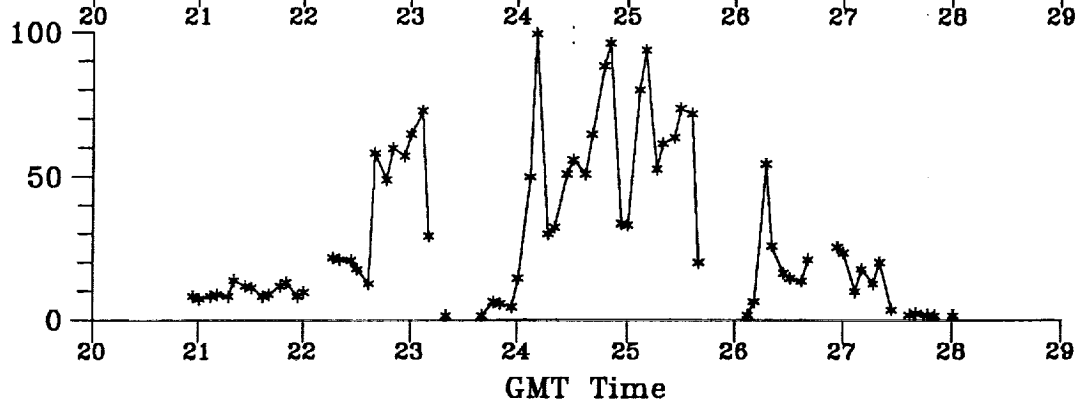
i-C3H7ONO2, pptv



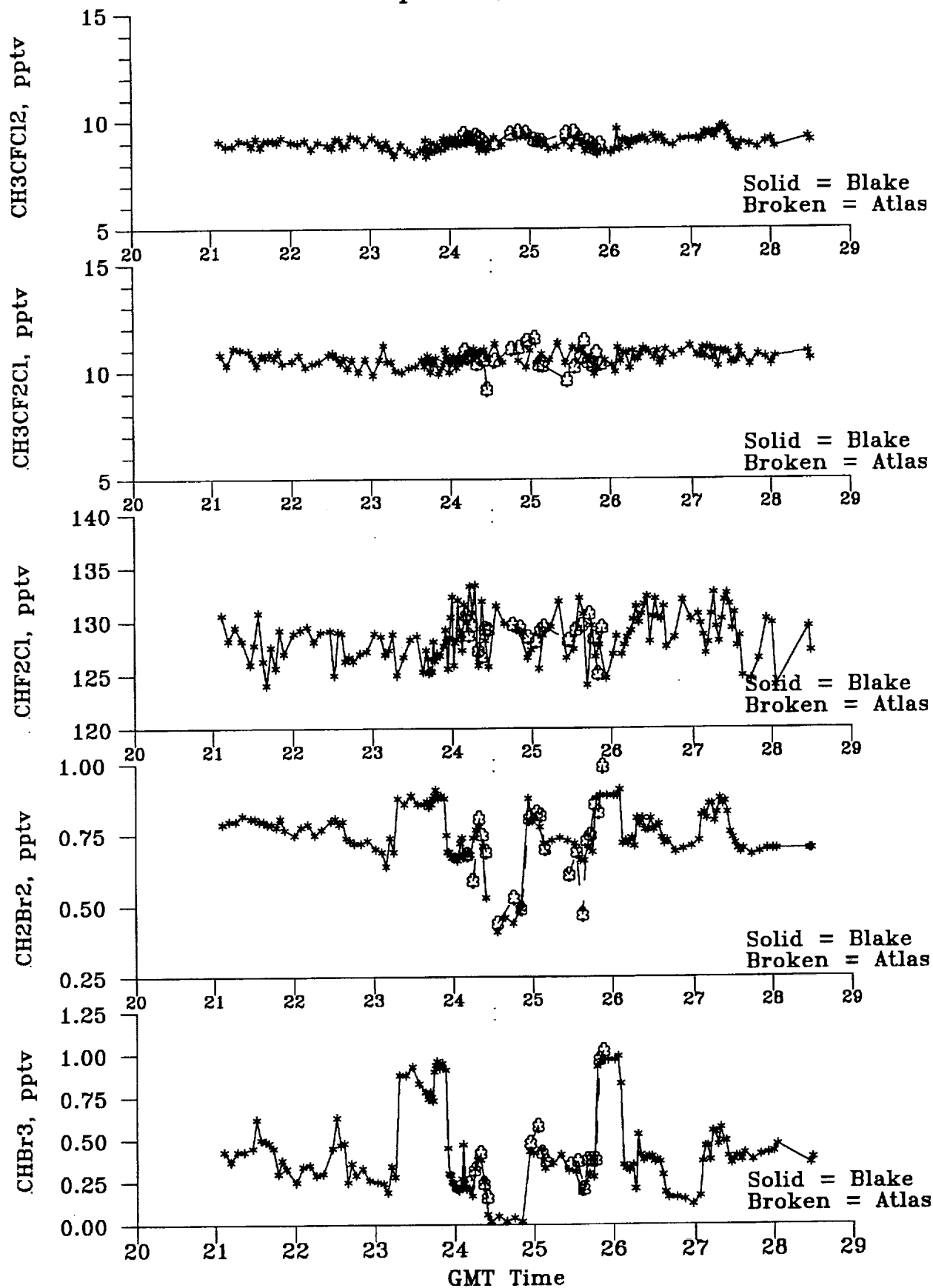
n-C3H7ONO2, pptv



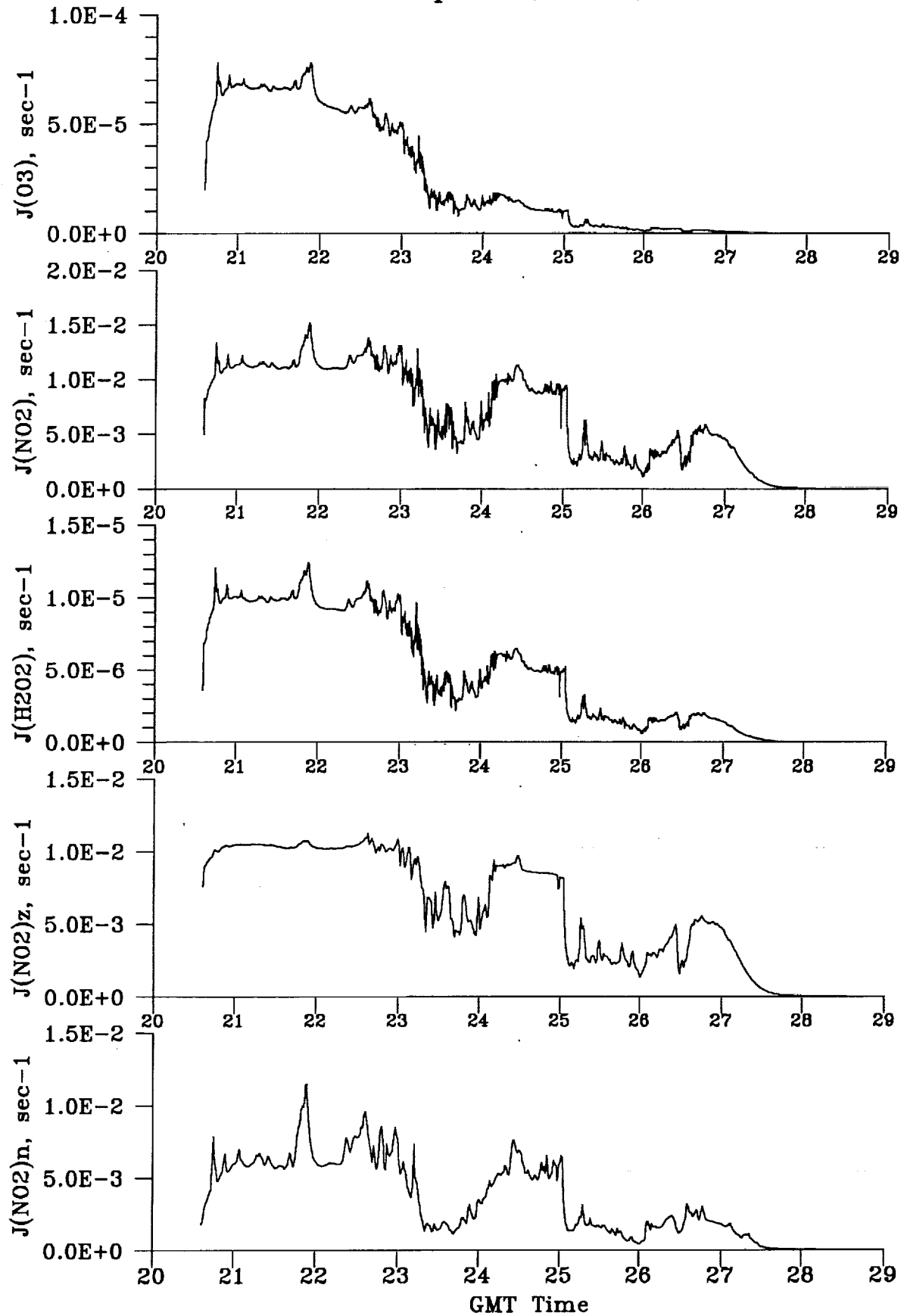
PAN, pptv



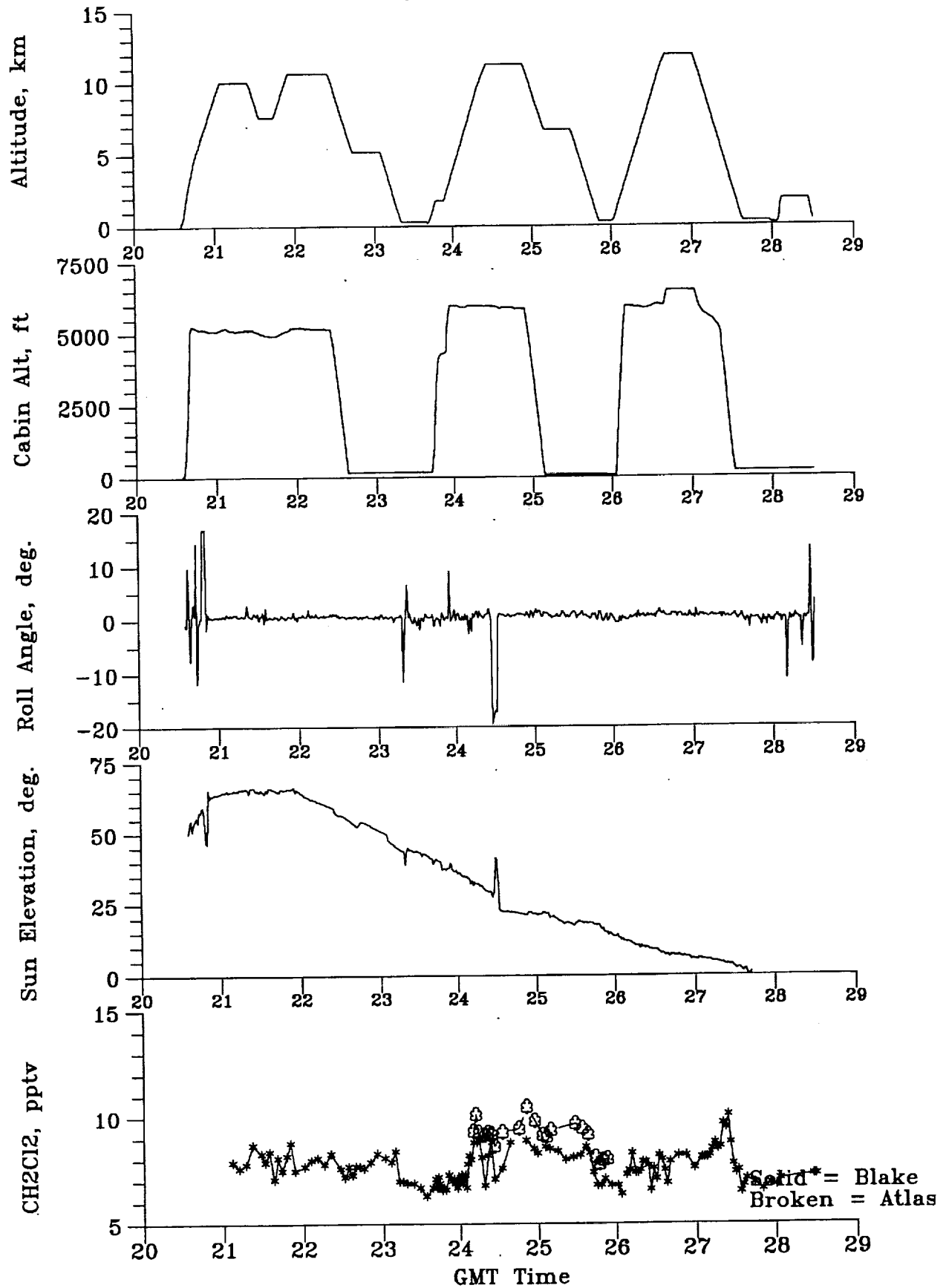
PEM Tropics B; DC-8; FLIGHT 14



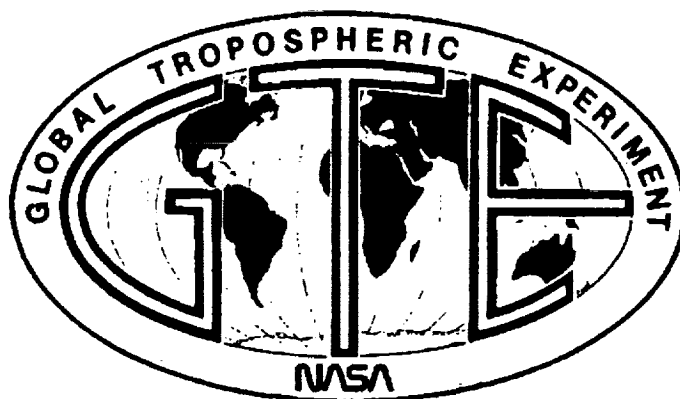
PEM Tropics B; DC-8; FLIGHT 14



PEM Tropics B; DC-8; FLIGHT 14



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

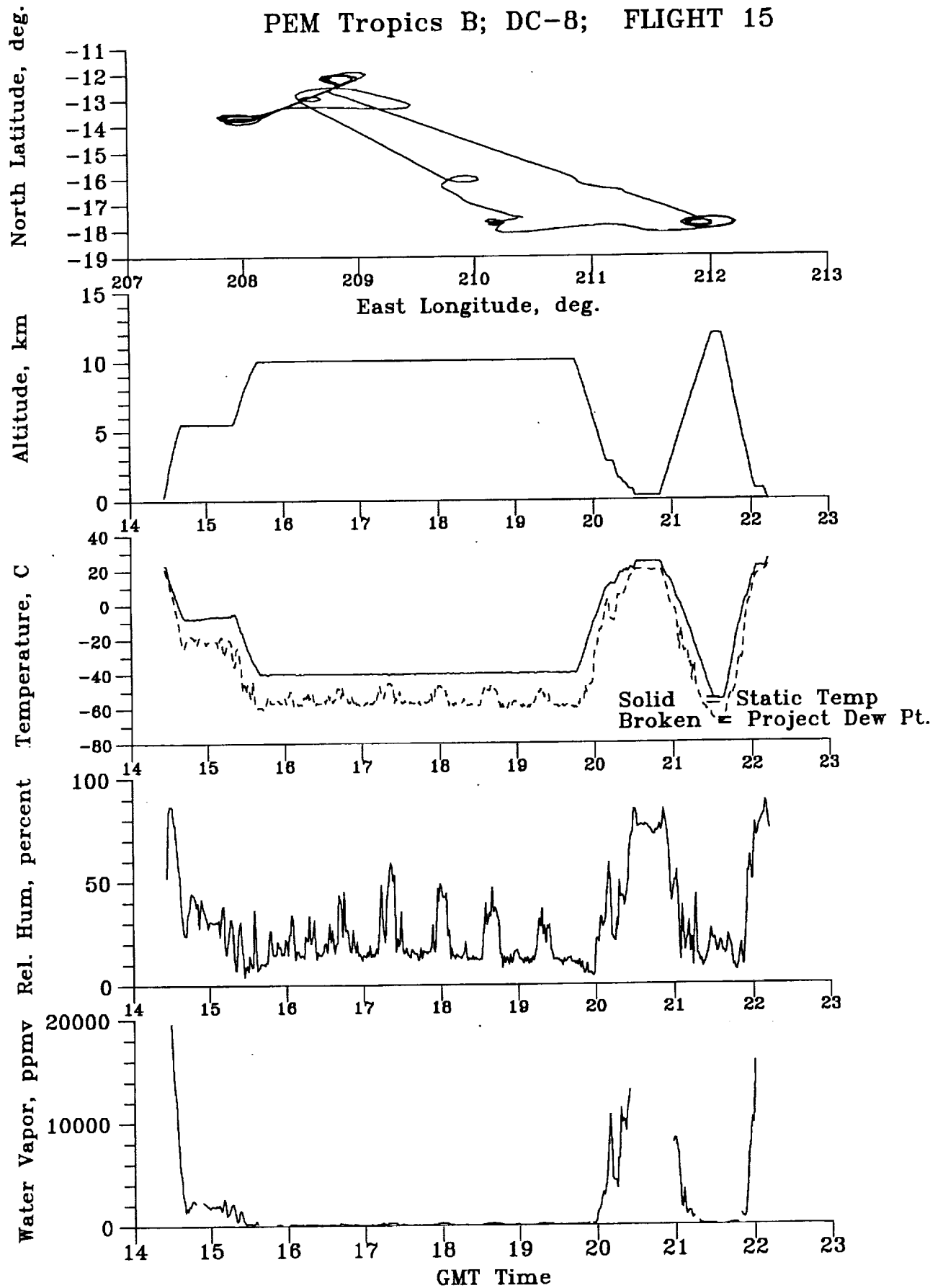
Flight 15D

Local: Tahiti No. 2

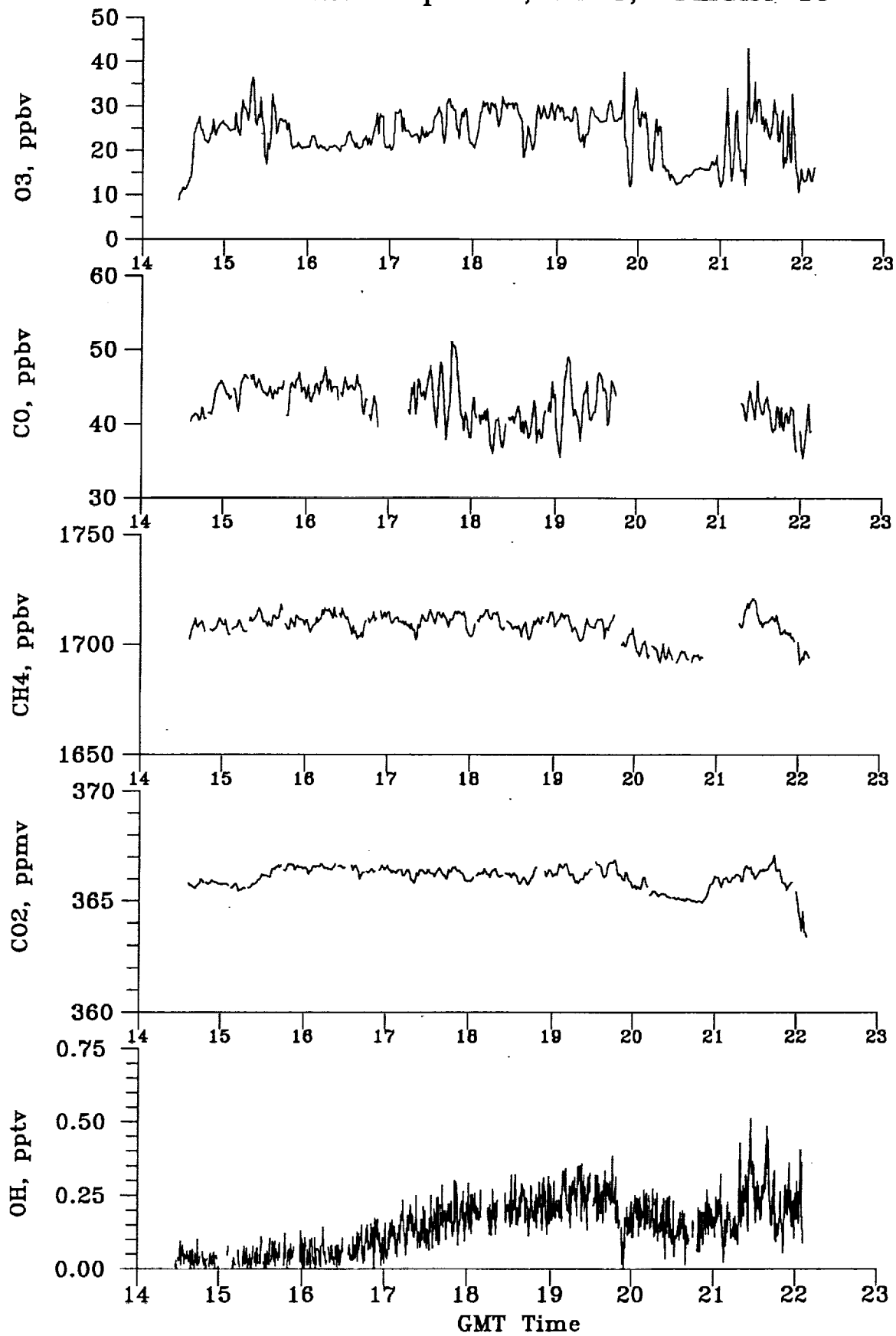
Sunrise HO_x/NO_x Chemistry

April 2, 1999

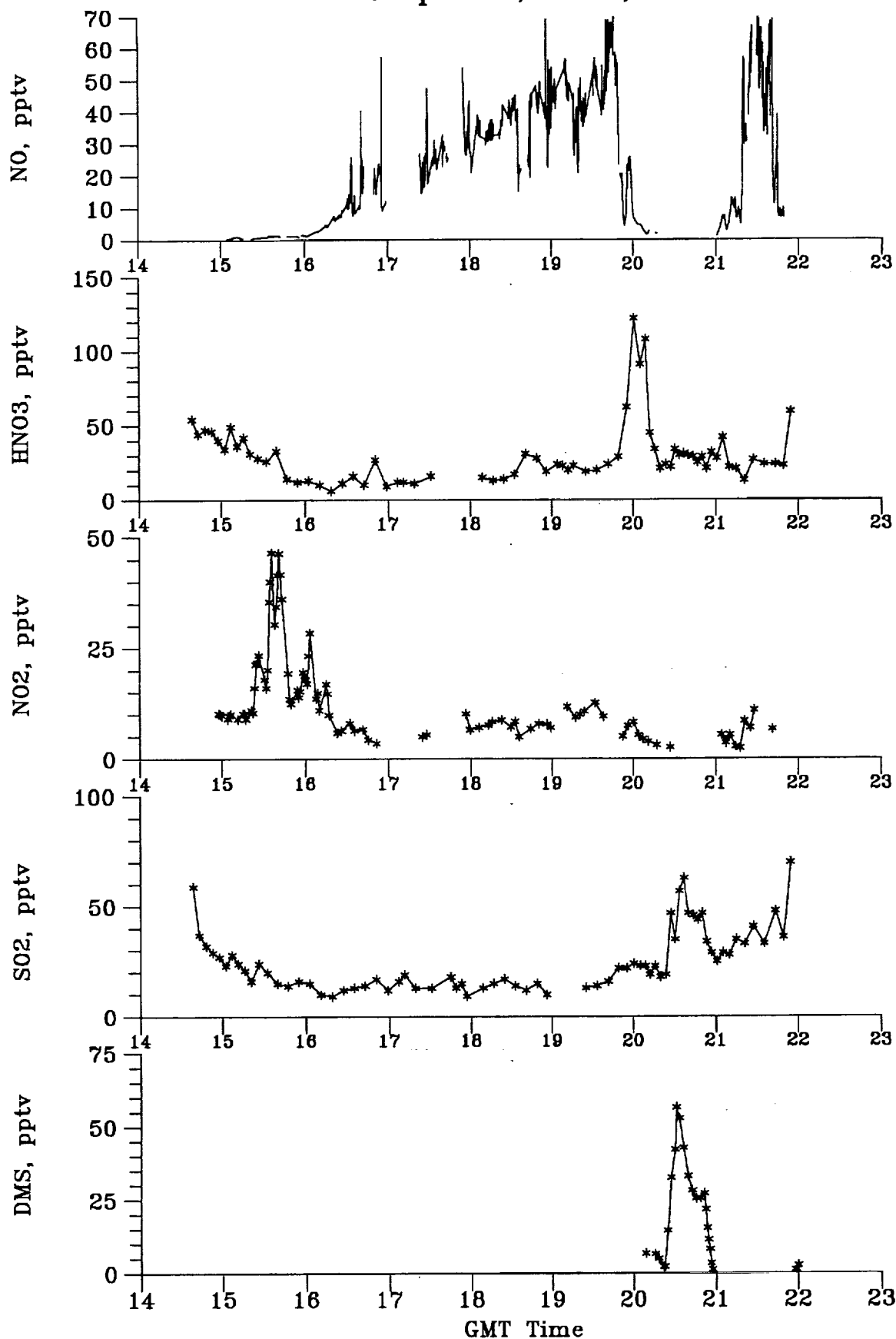
PEM Tropics B; DC-8; FLIGHT 15



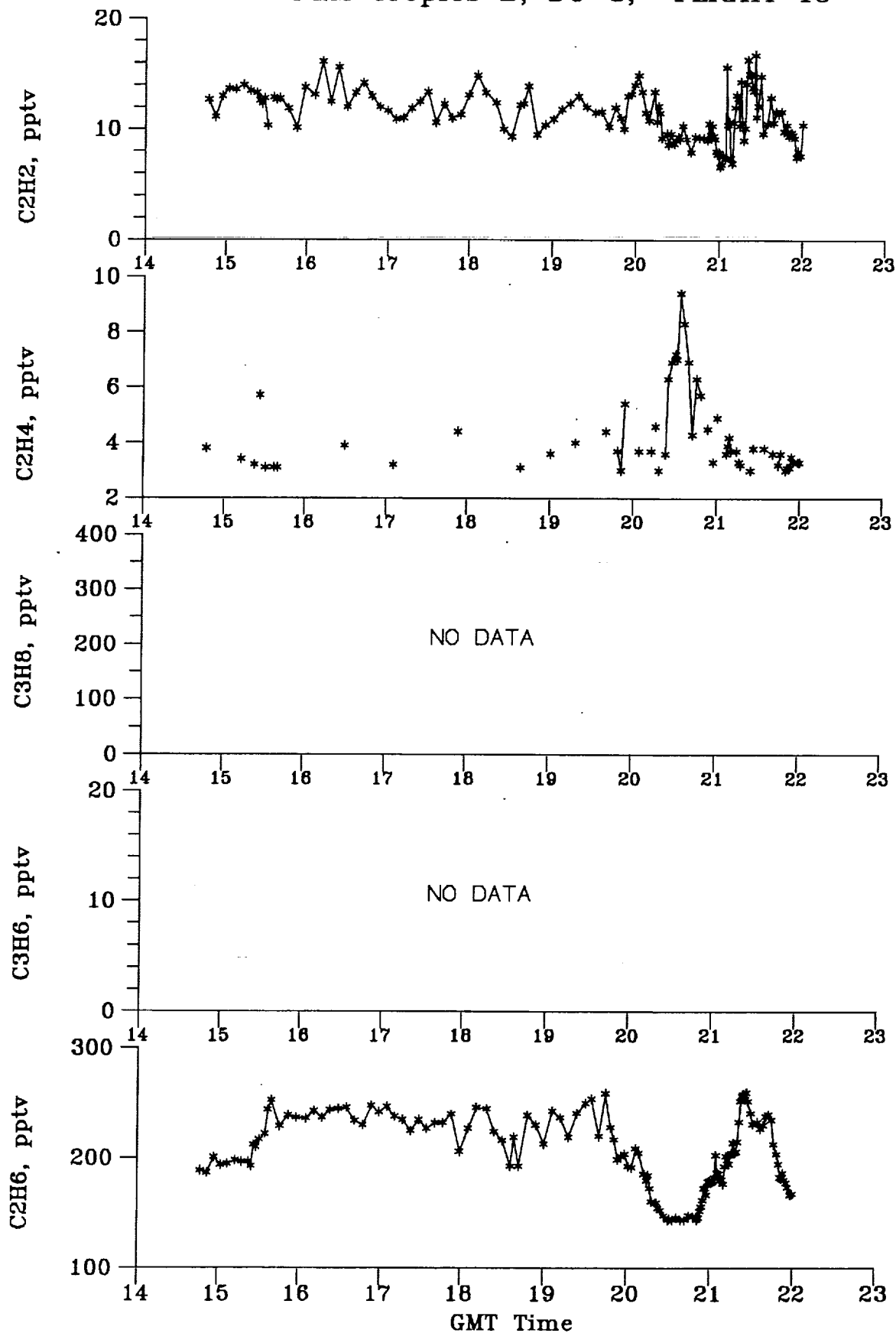
PEM Tropics B; DC-8; FLIGHT 15



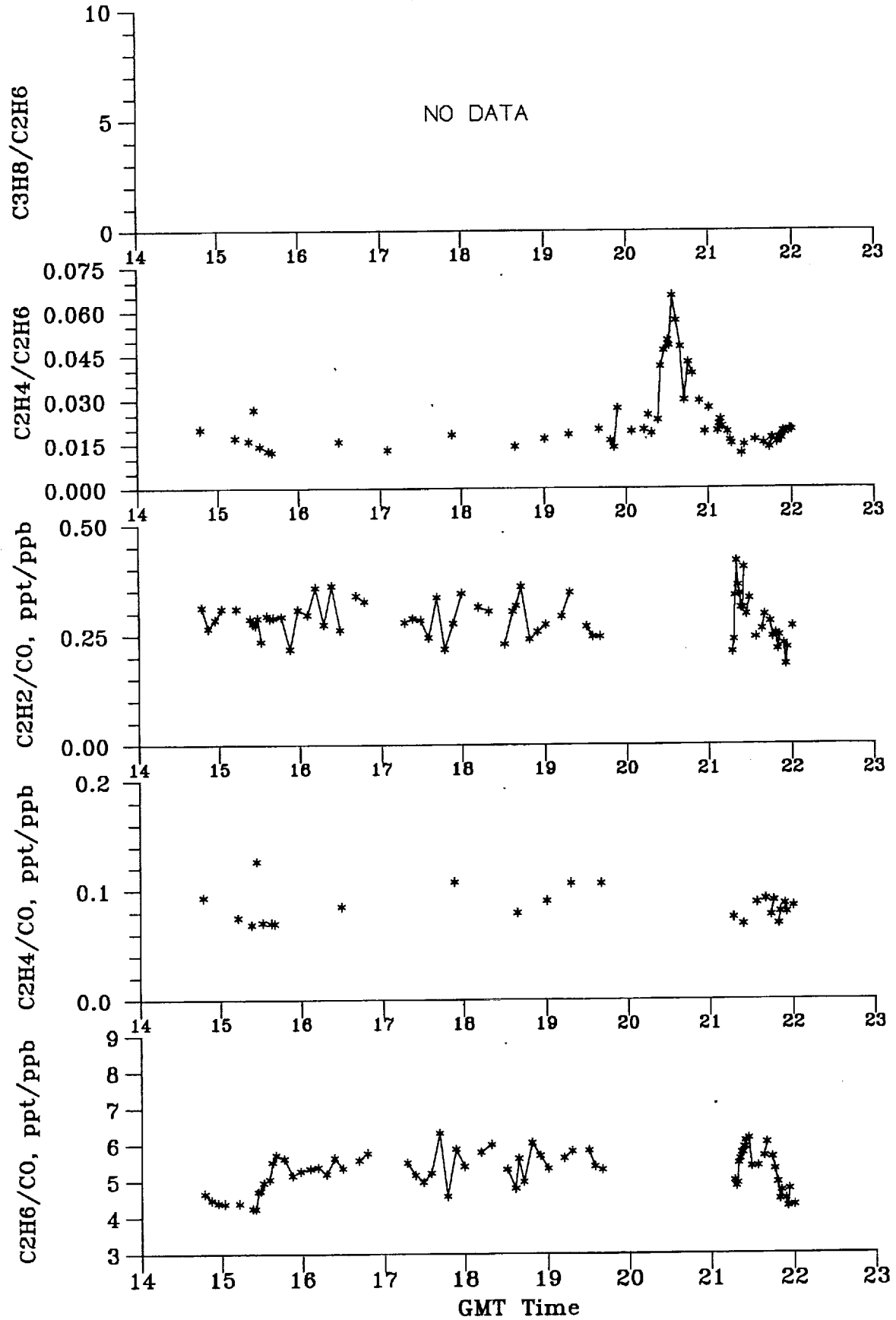
PEM Tropics B; DC-8; FLIGHT 15



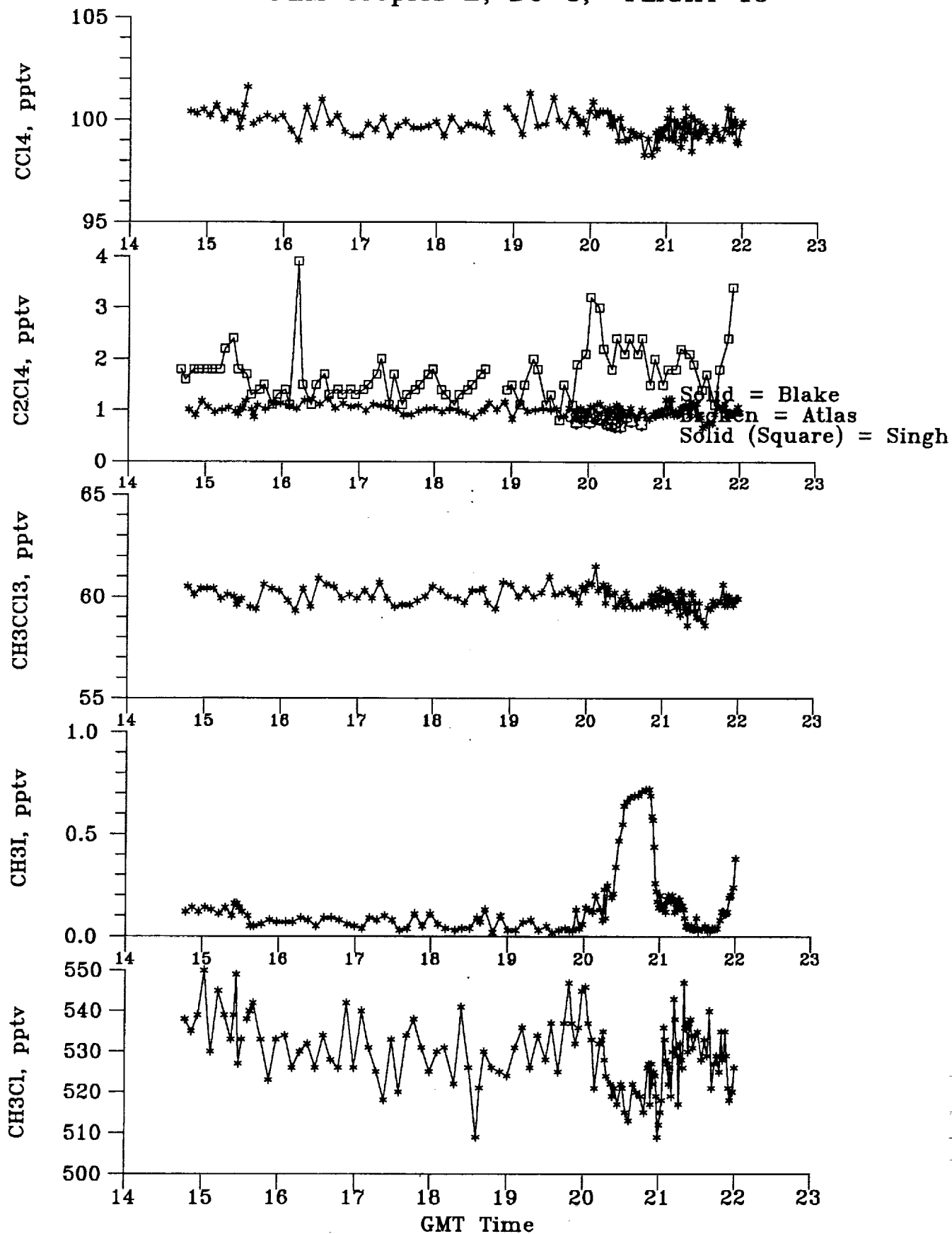
PEM Tropics B; DC-8; FLIGHT 15



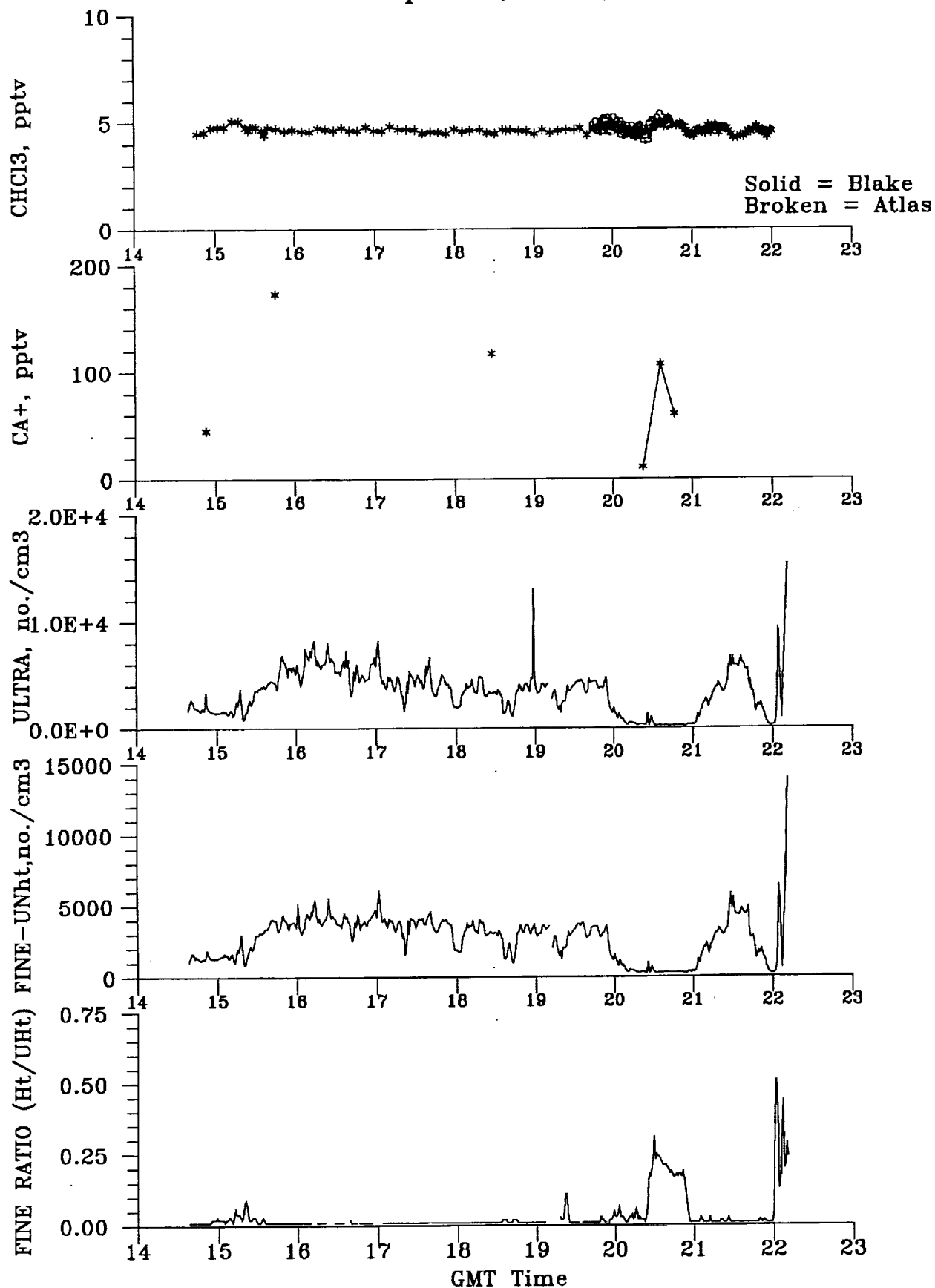
PEM Tropics B; DC-8; FLIGHT 15



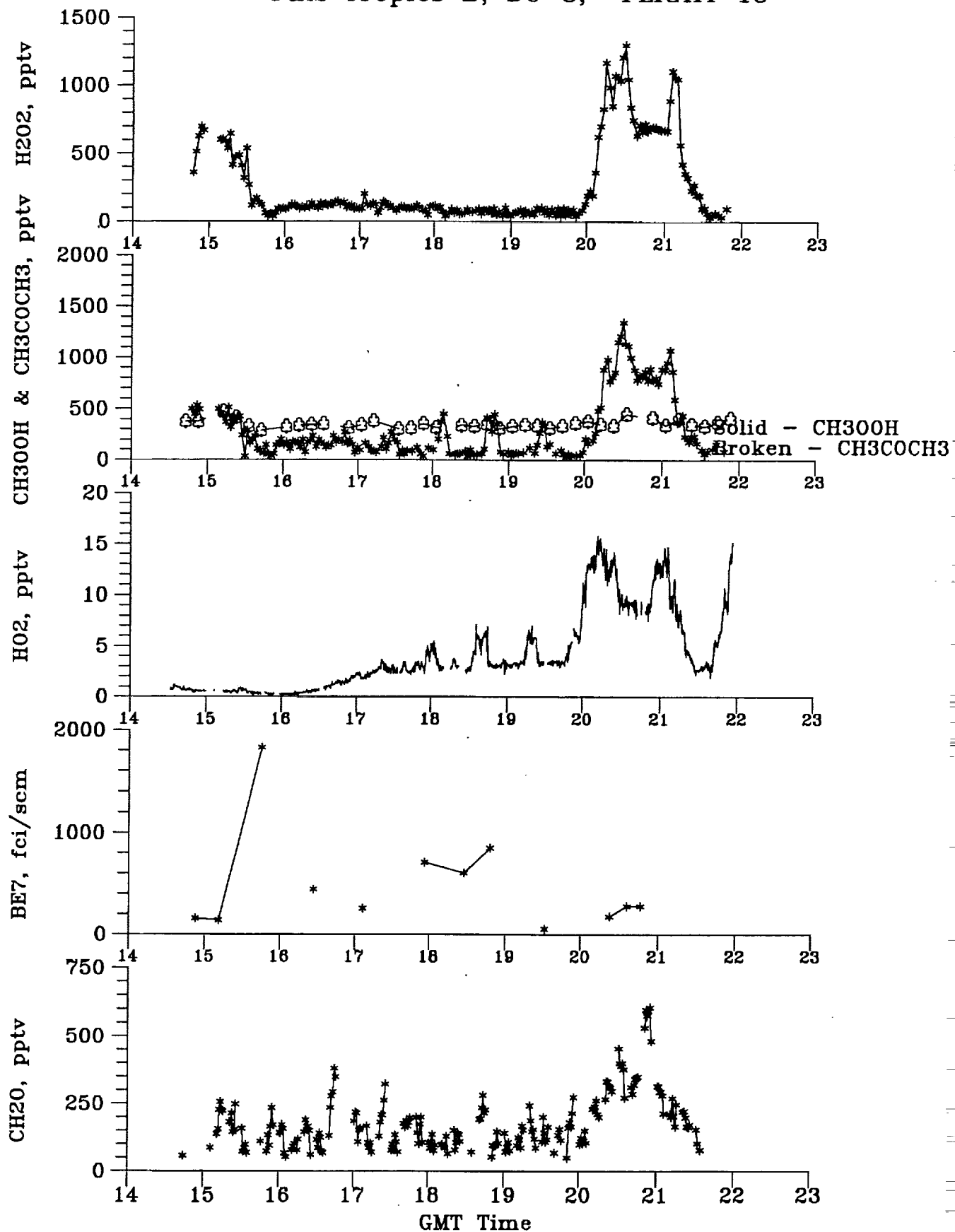
PEM Tropics B; DC-8; FLIGHT 15



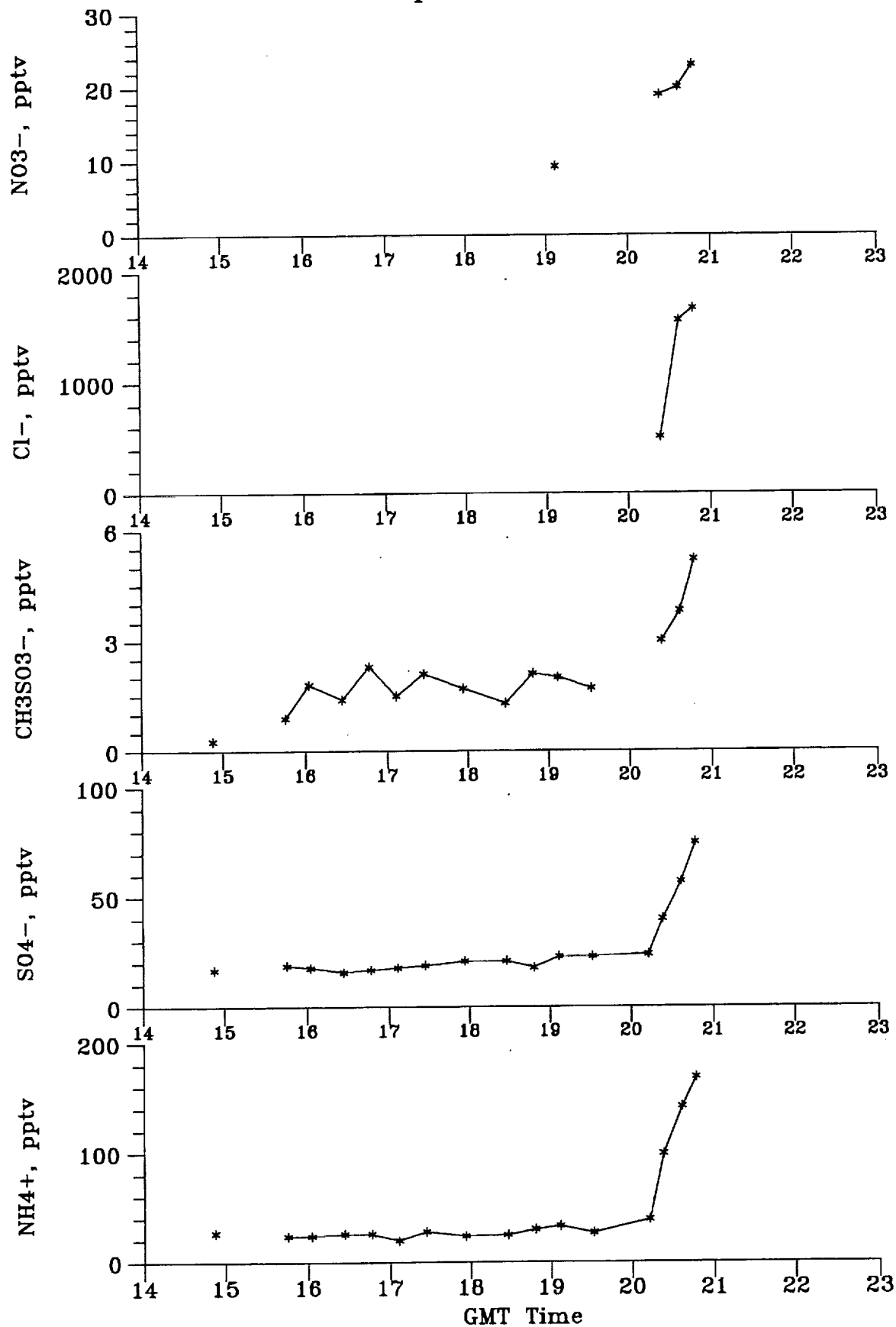
PEM Tropics B; DC-8; FLIGHT 15



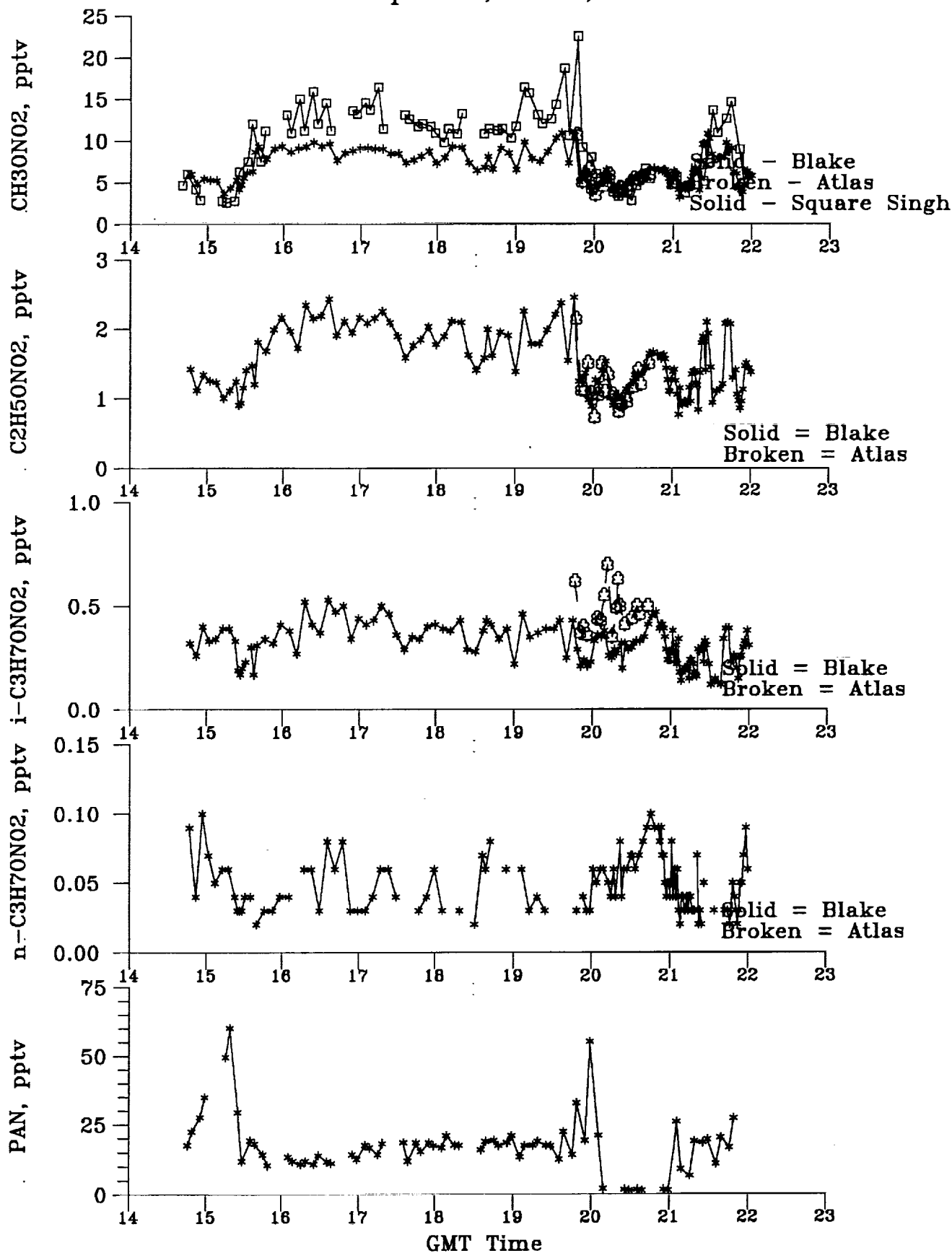
PEM Tropics B; DC-8; FLIGHT 15



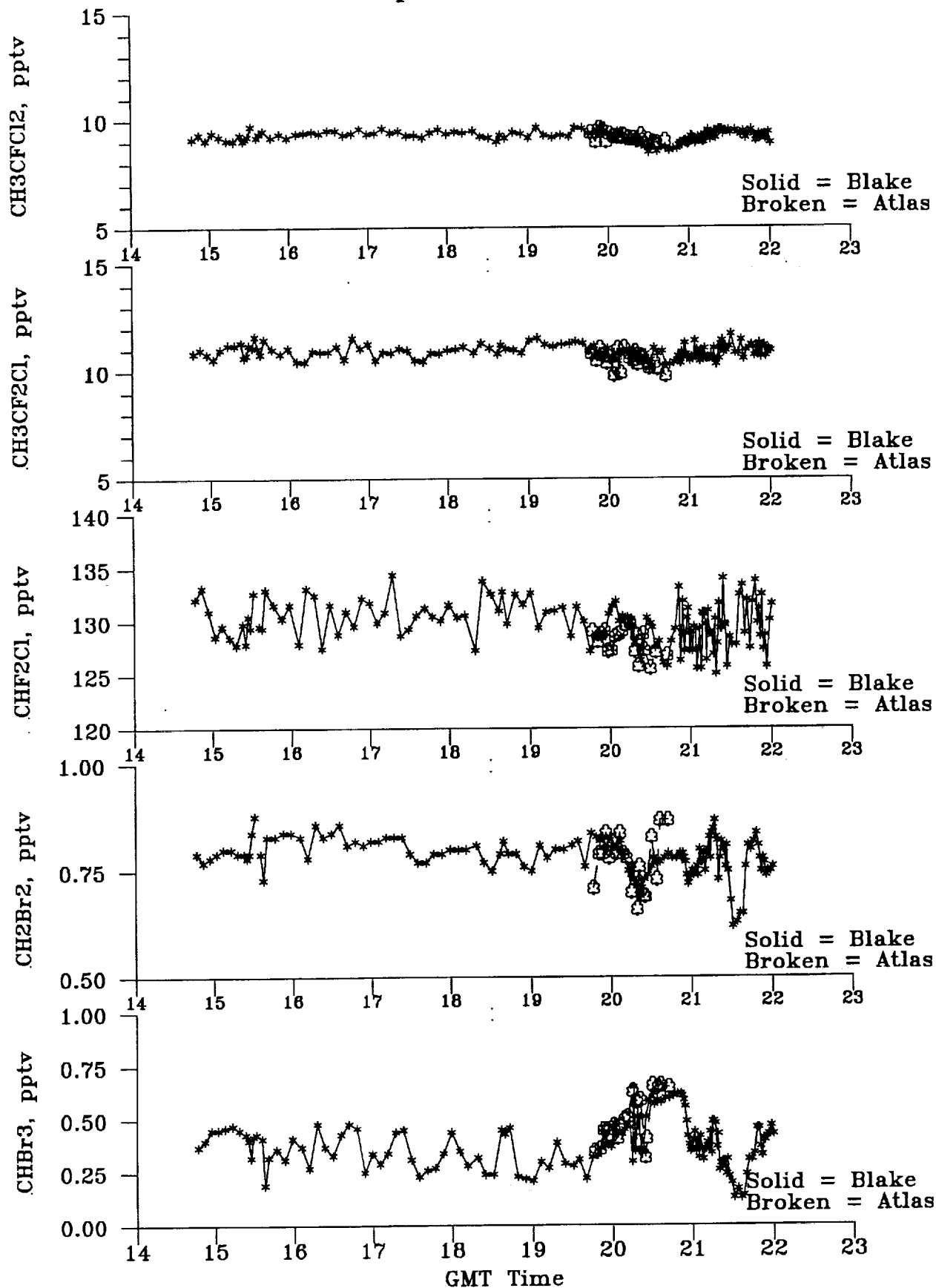
PEM Tropics B; DC-8; FLIGHT 15



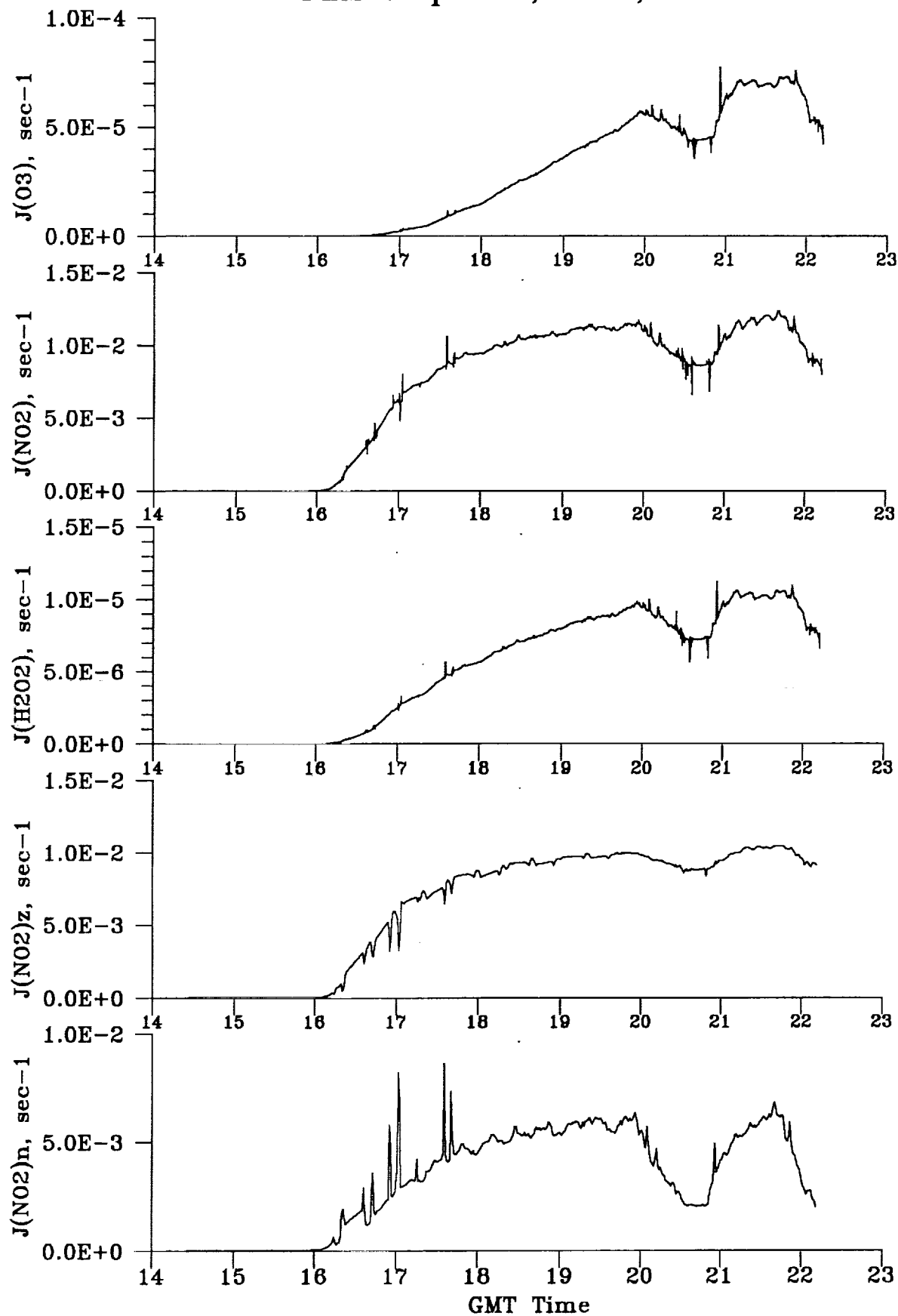
PEM Tropics B; DC-8; FLIGHT 15



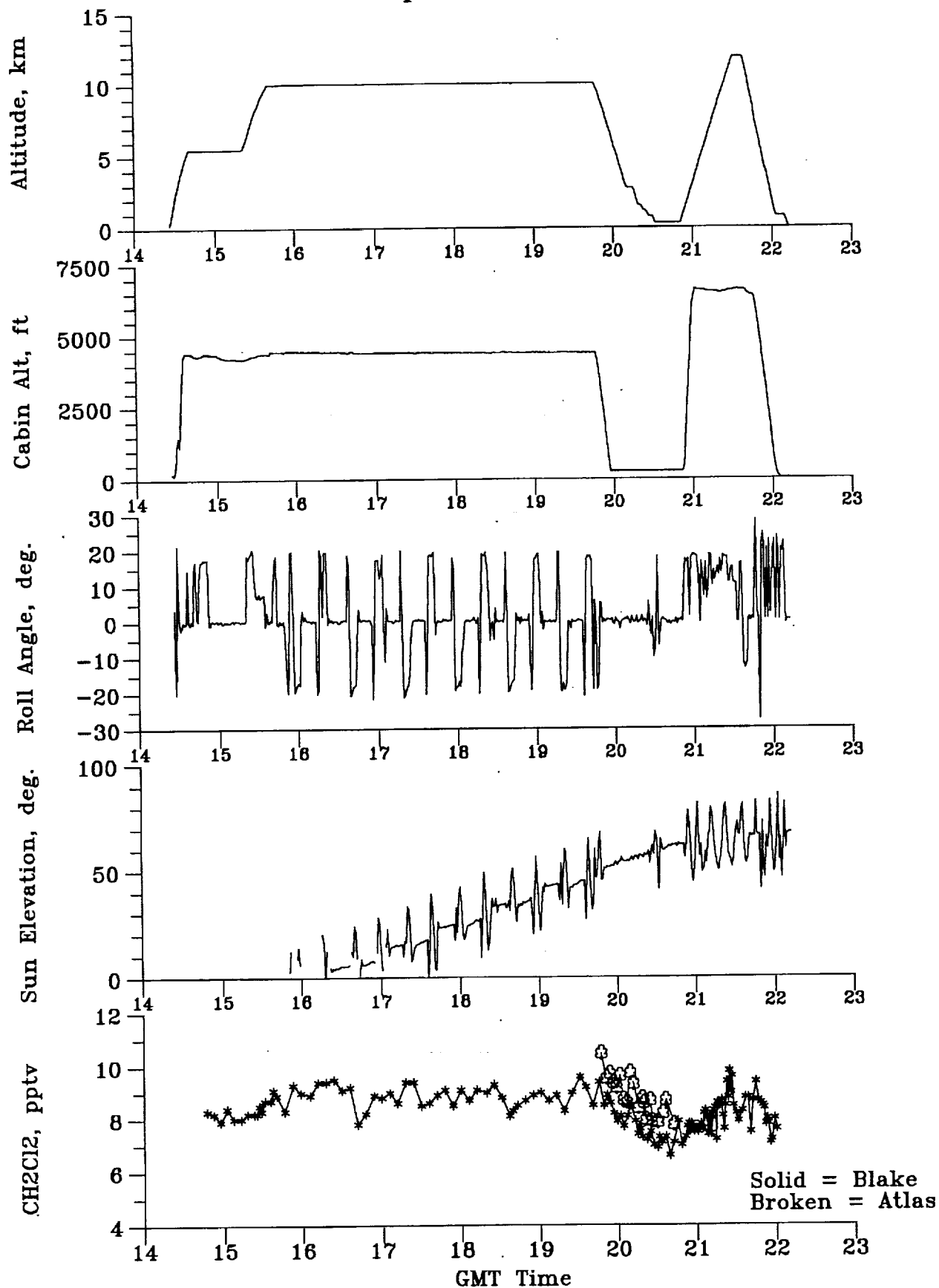
PEM Tropics B; DC-8; FLIGHT 15



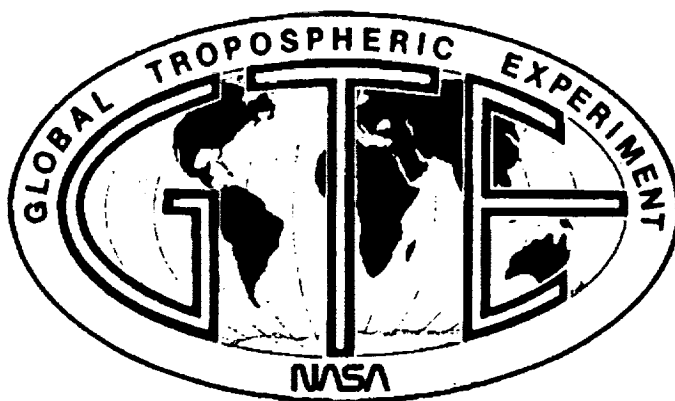
PEM Tropics B; DC-8; FLIGHT 15



PEM Tropics B; DC-8; FLIGHT 15



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

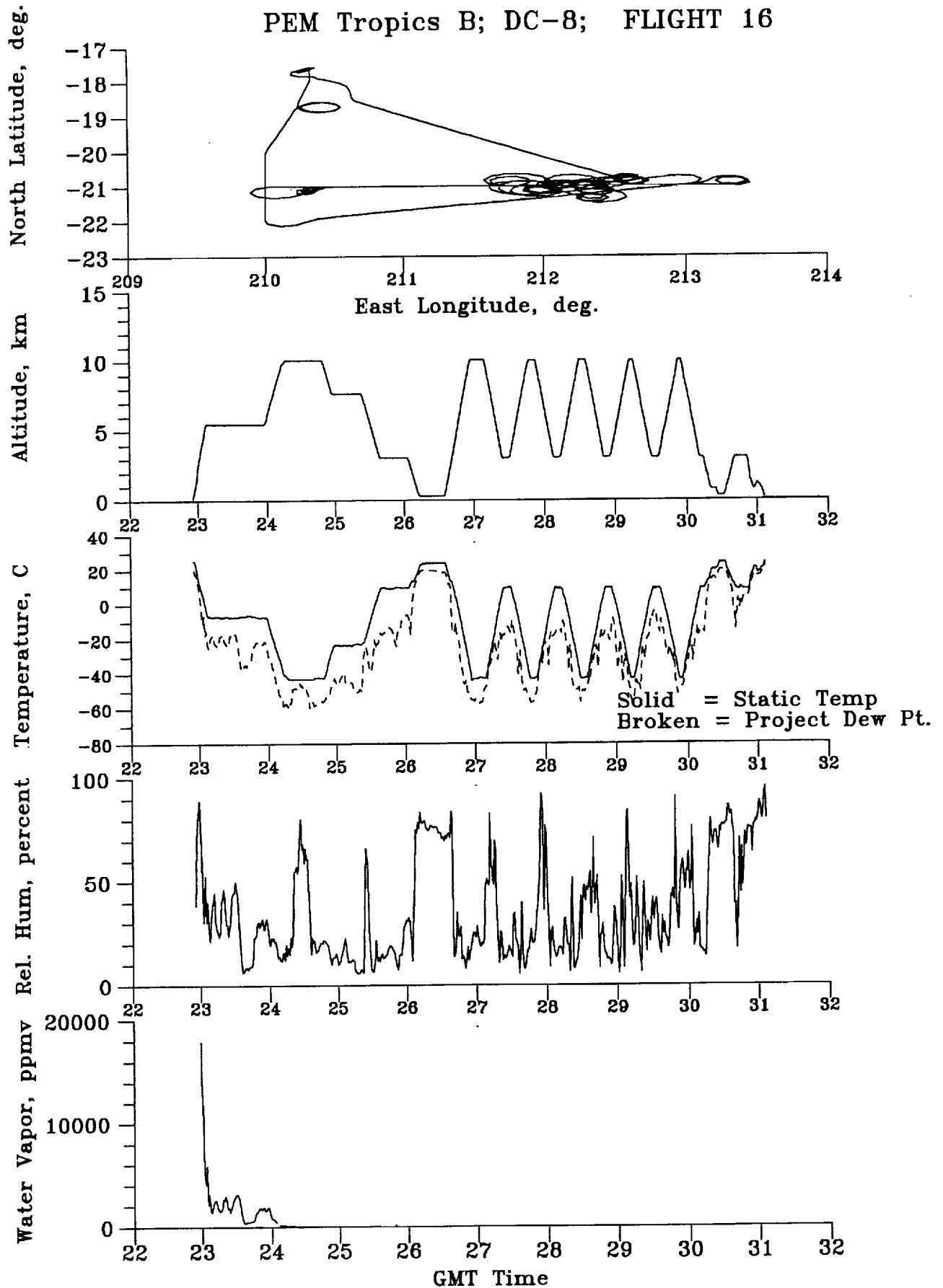
Flight 16D

Local: Tahiti No. 3

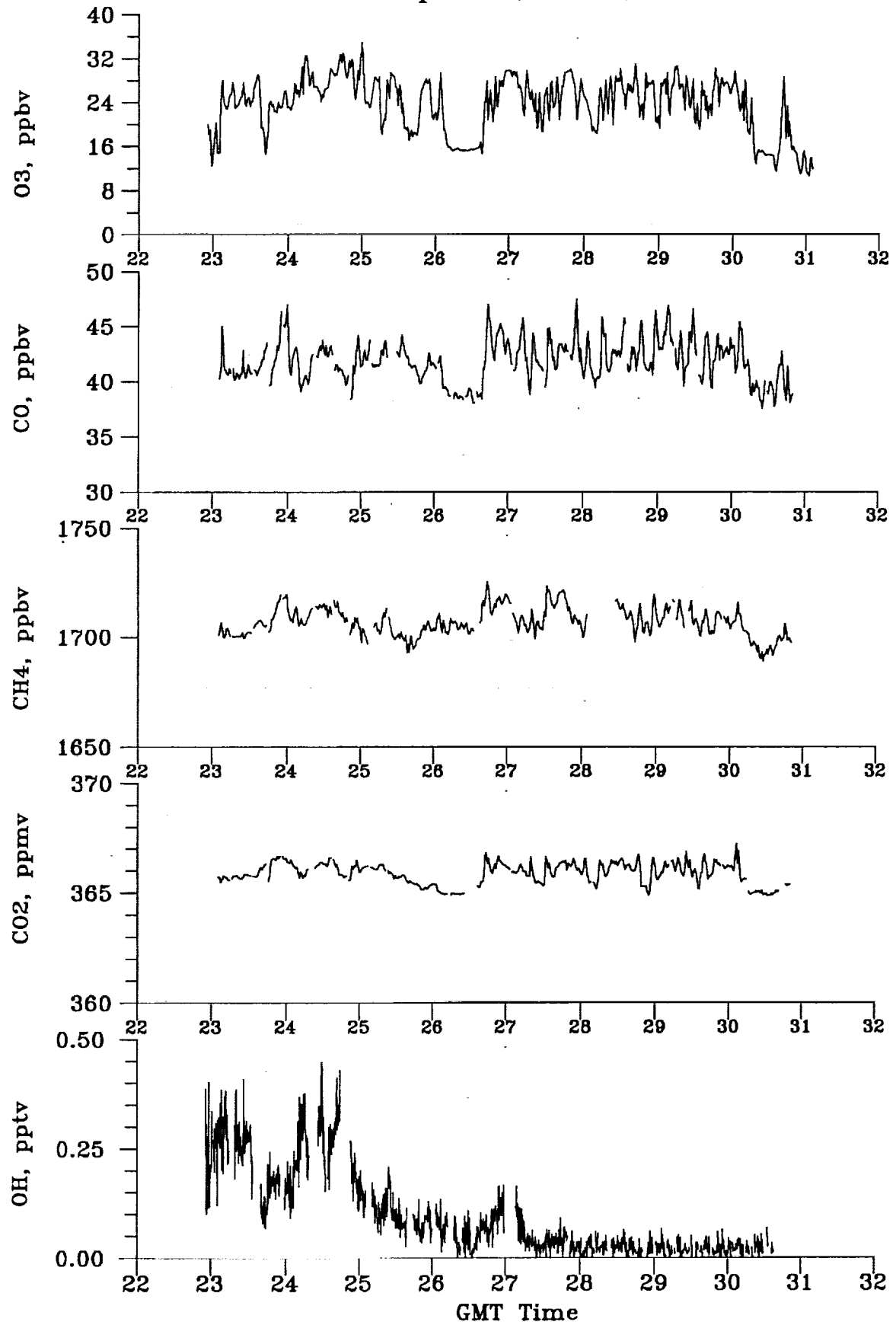
Sunset HO_x/NO_x Chemistry

April 4, 1999

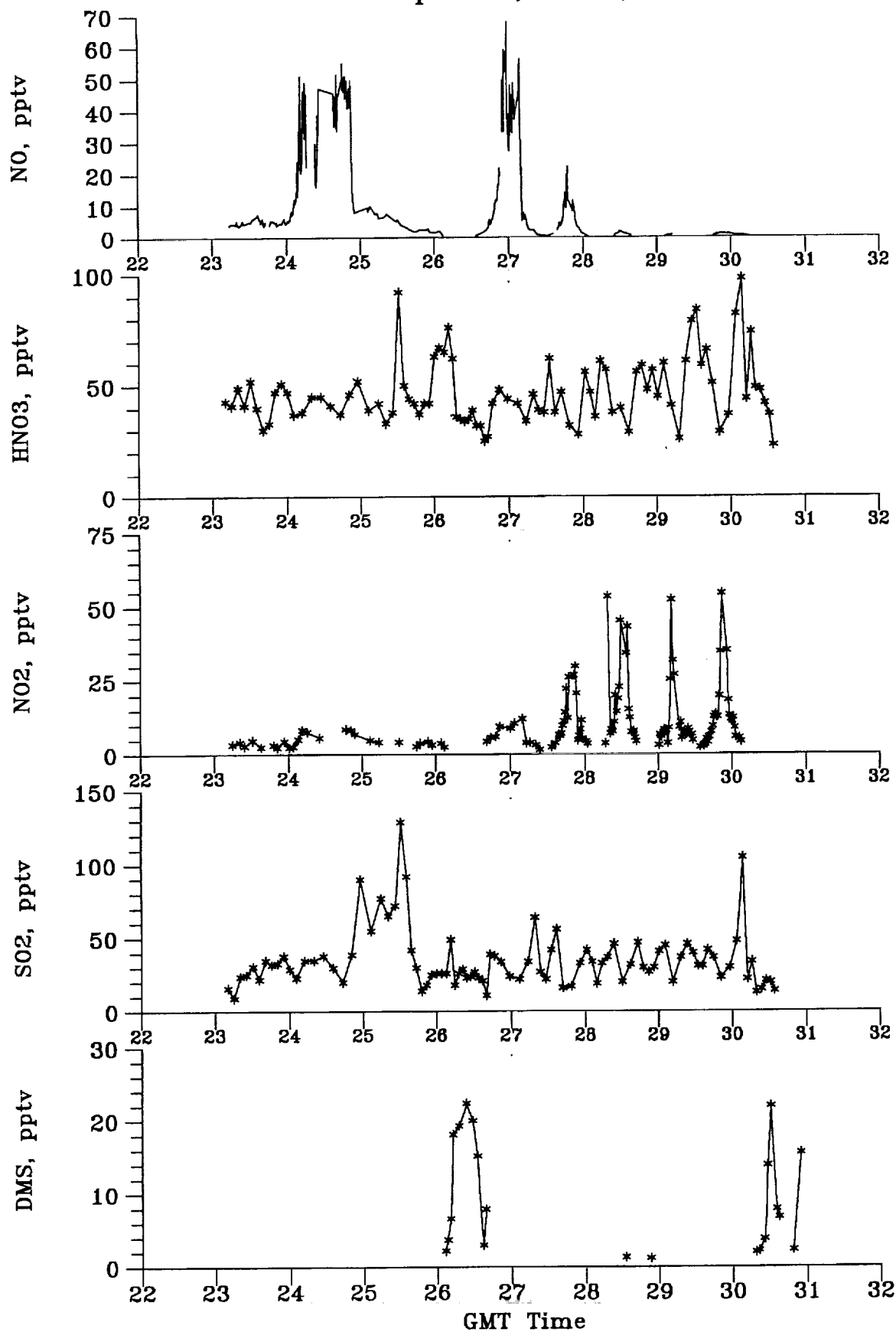
PEM Tropics B; DC-8; FLIGHT 16



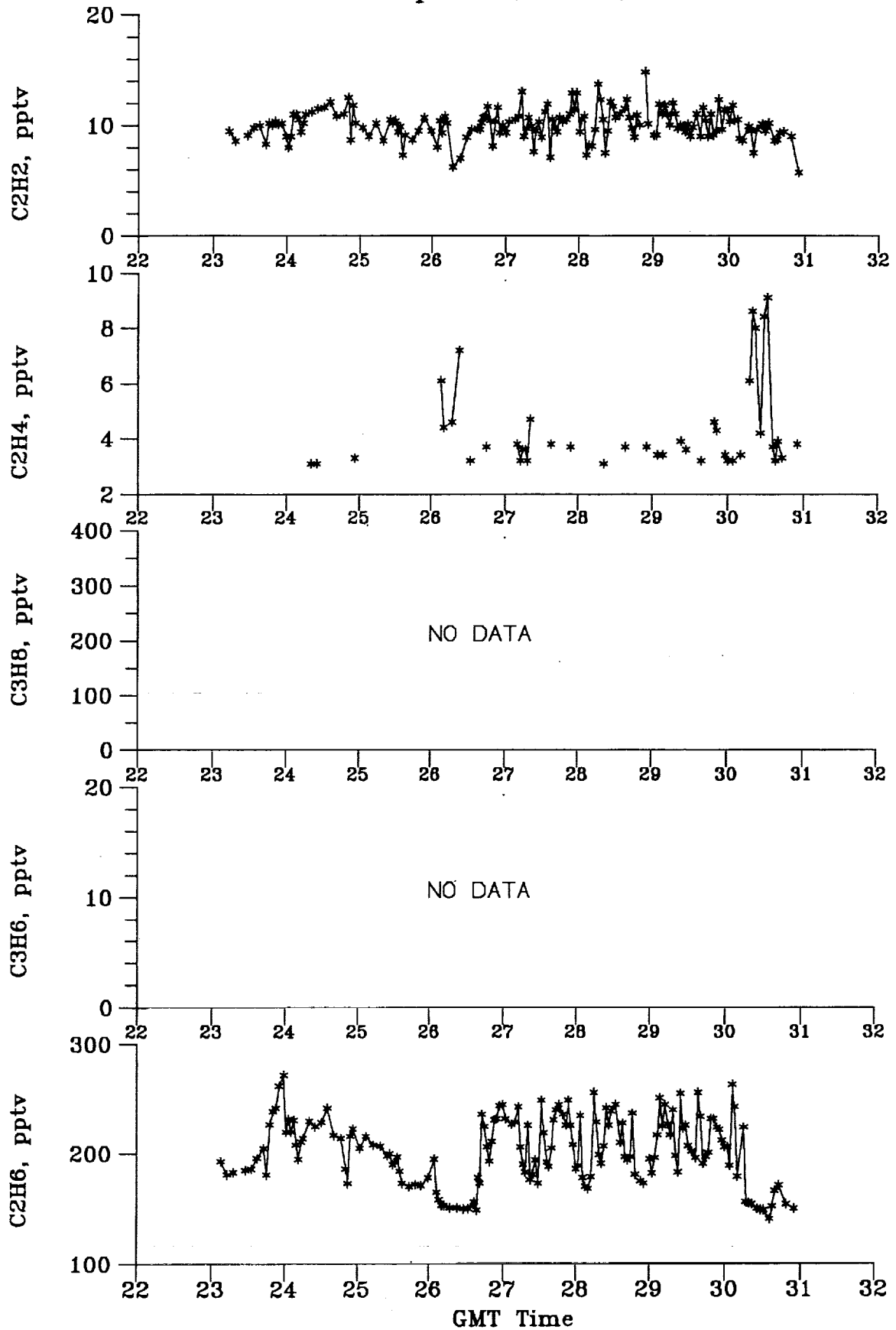
PEM Tropics B; DC-8; FLIGHT 16



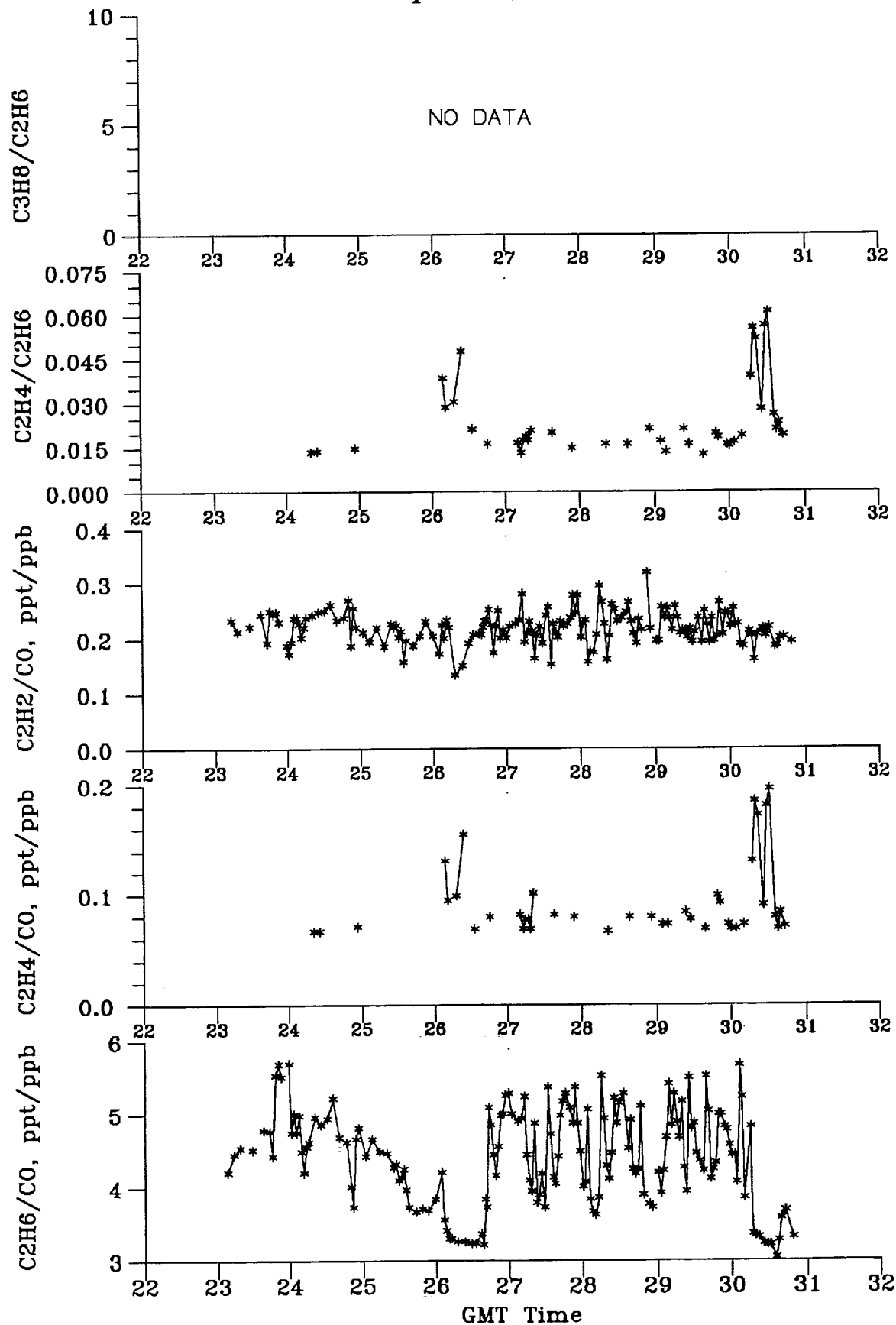
PEM Tropics B; DC-8; FLIGHT 16



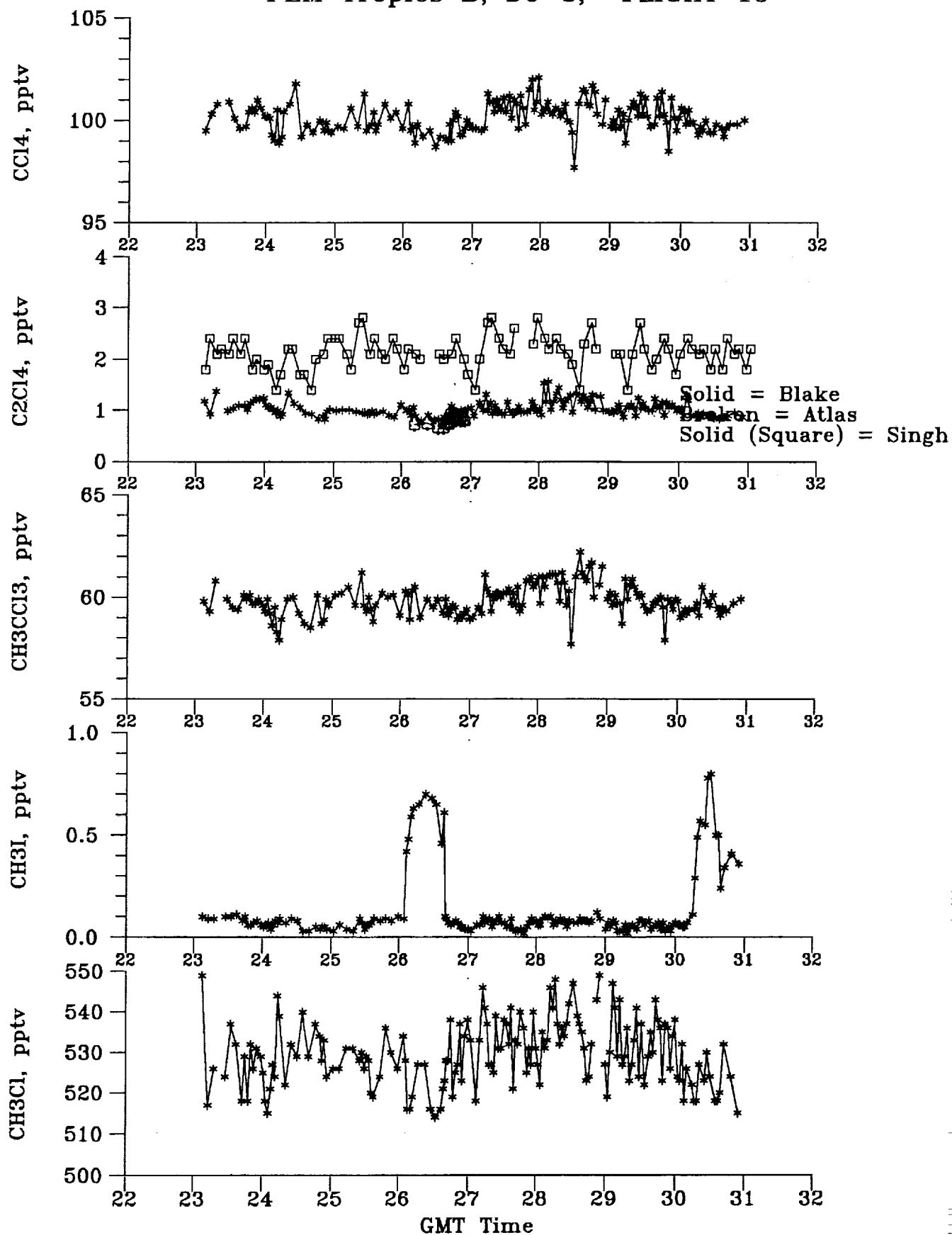
PEM Tropics B; DC-8; FLIGHT 16



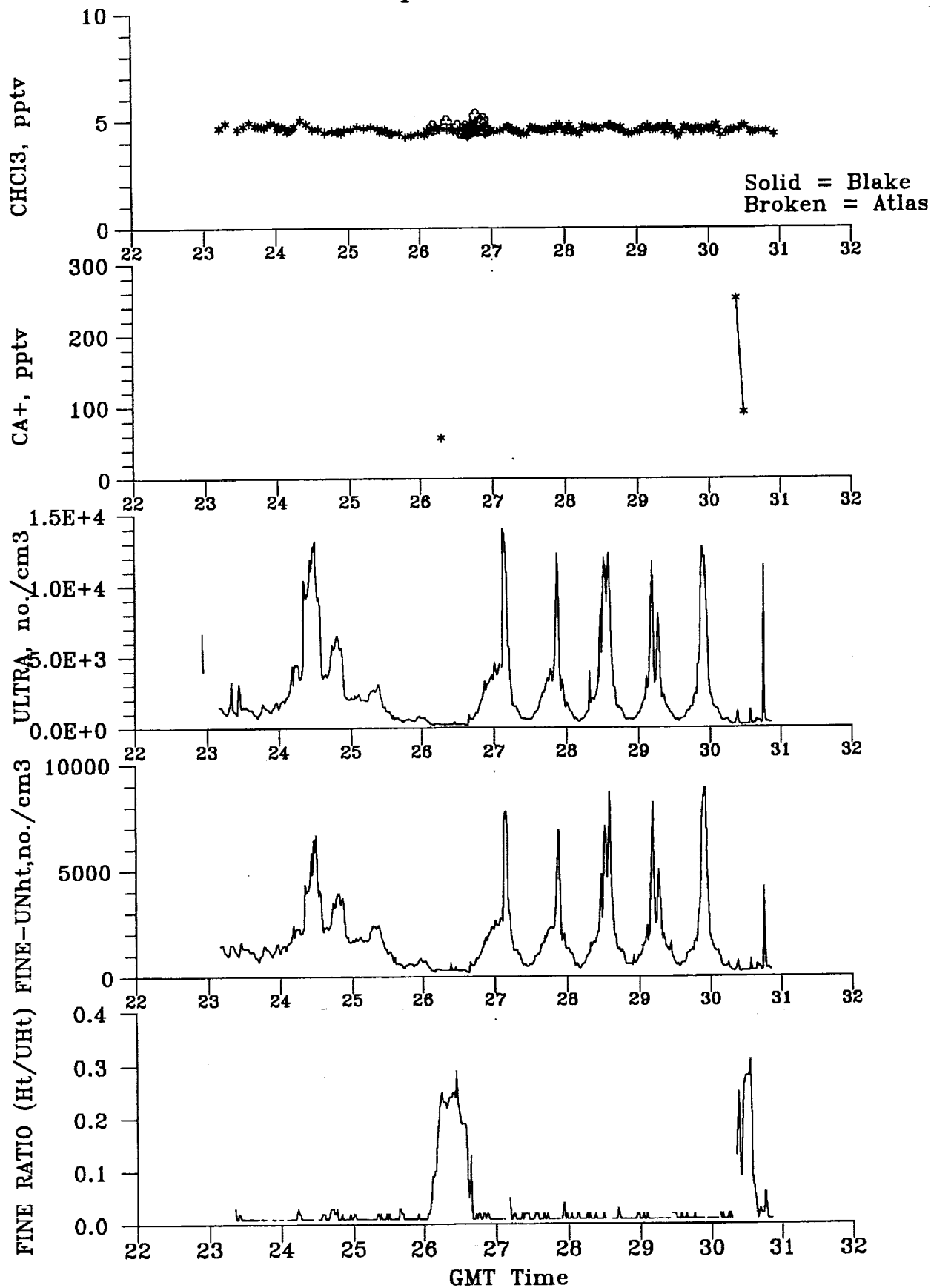
PEM Tropics B; DC-8; FLIGHT 16



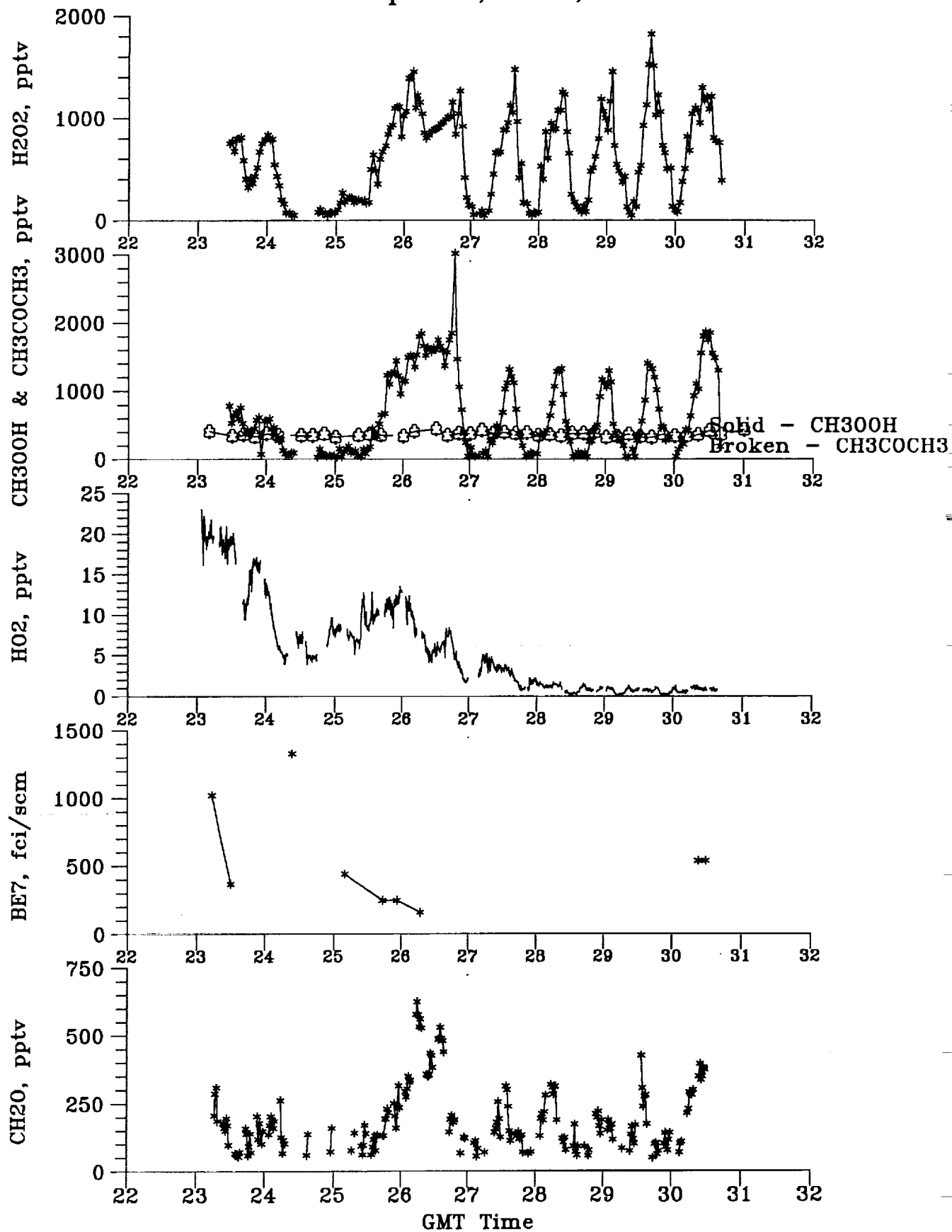
PEM Tropics B; DC-8; FLIGHT 16



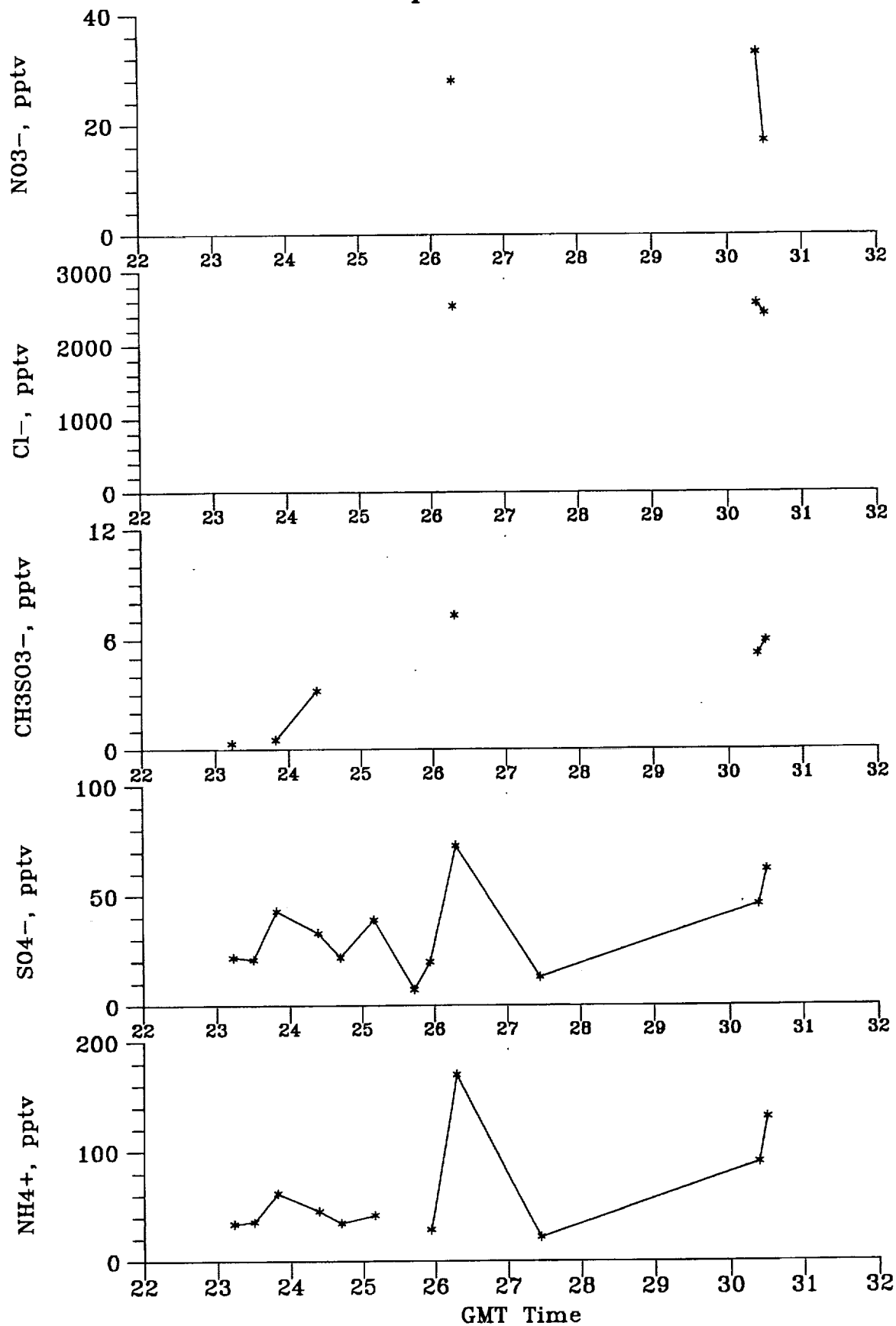
PEM Tropics B; DC-8; FLIGHT 16



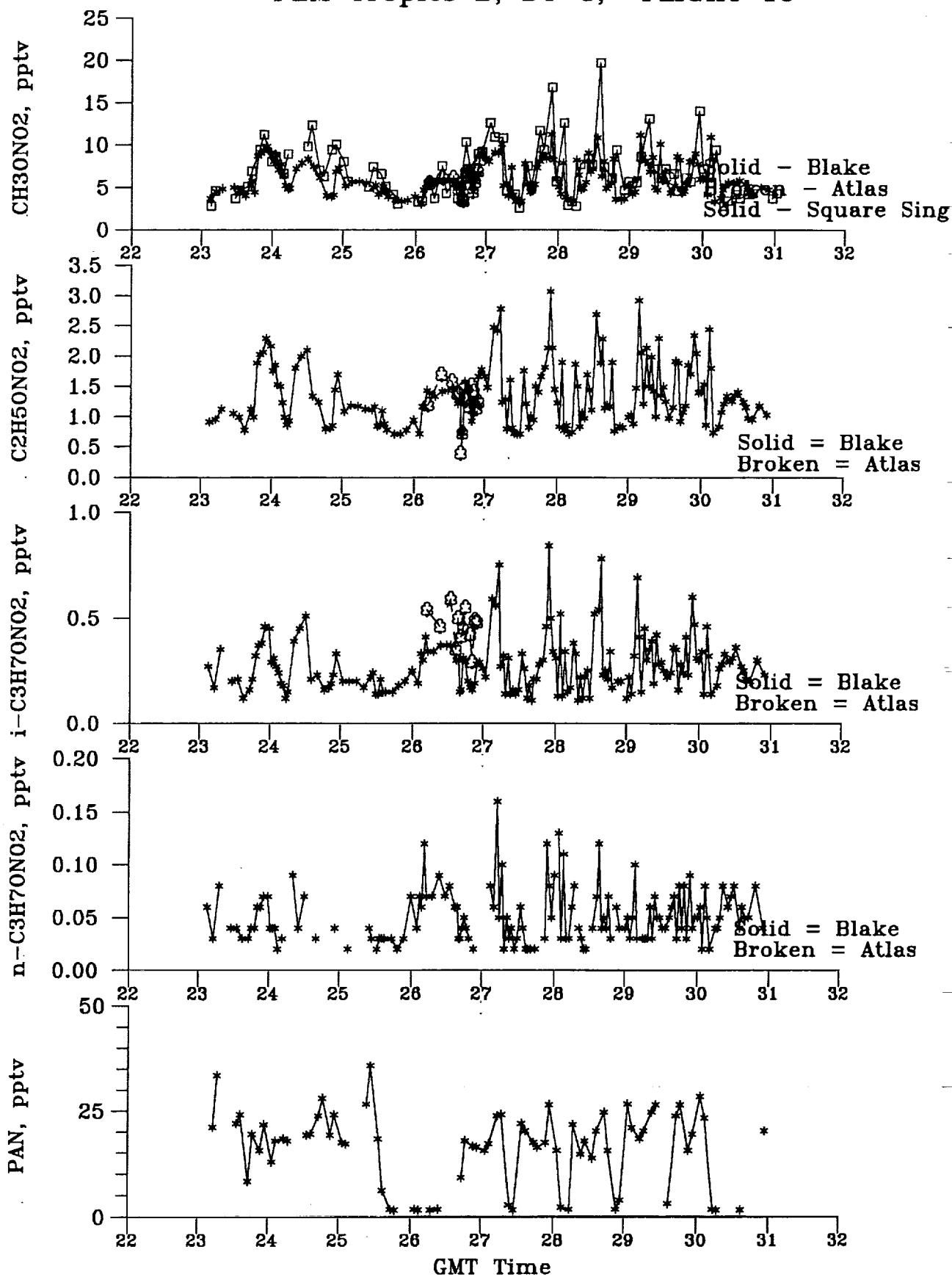
PEM Tropics B; DC-8; FLIGHT 16



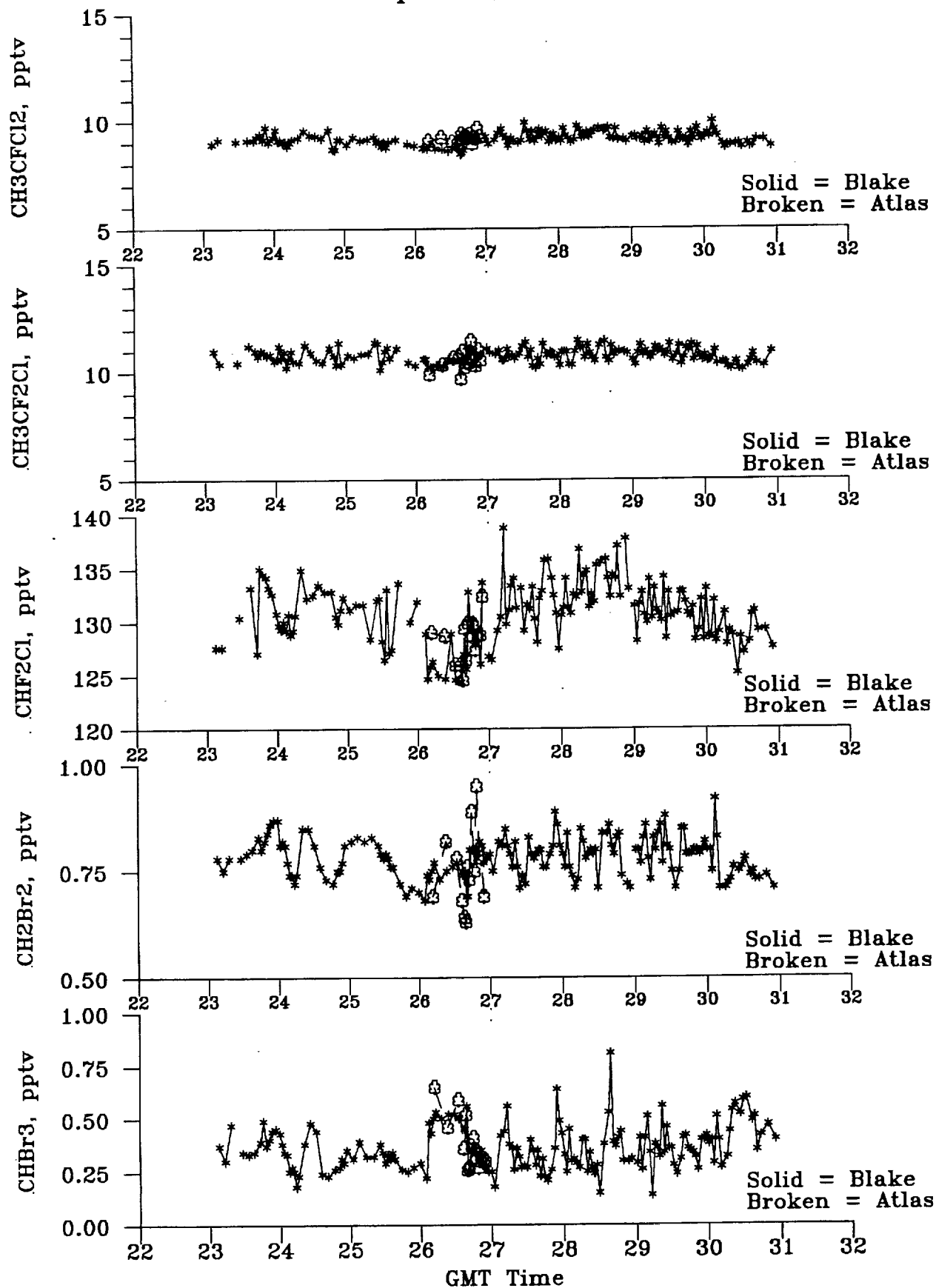
PEM Tropics B; DC-8; FLIGHT 16



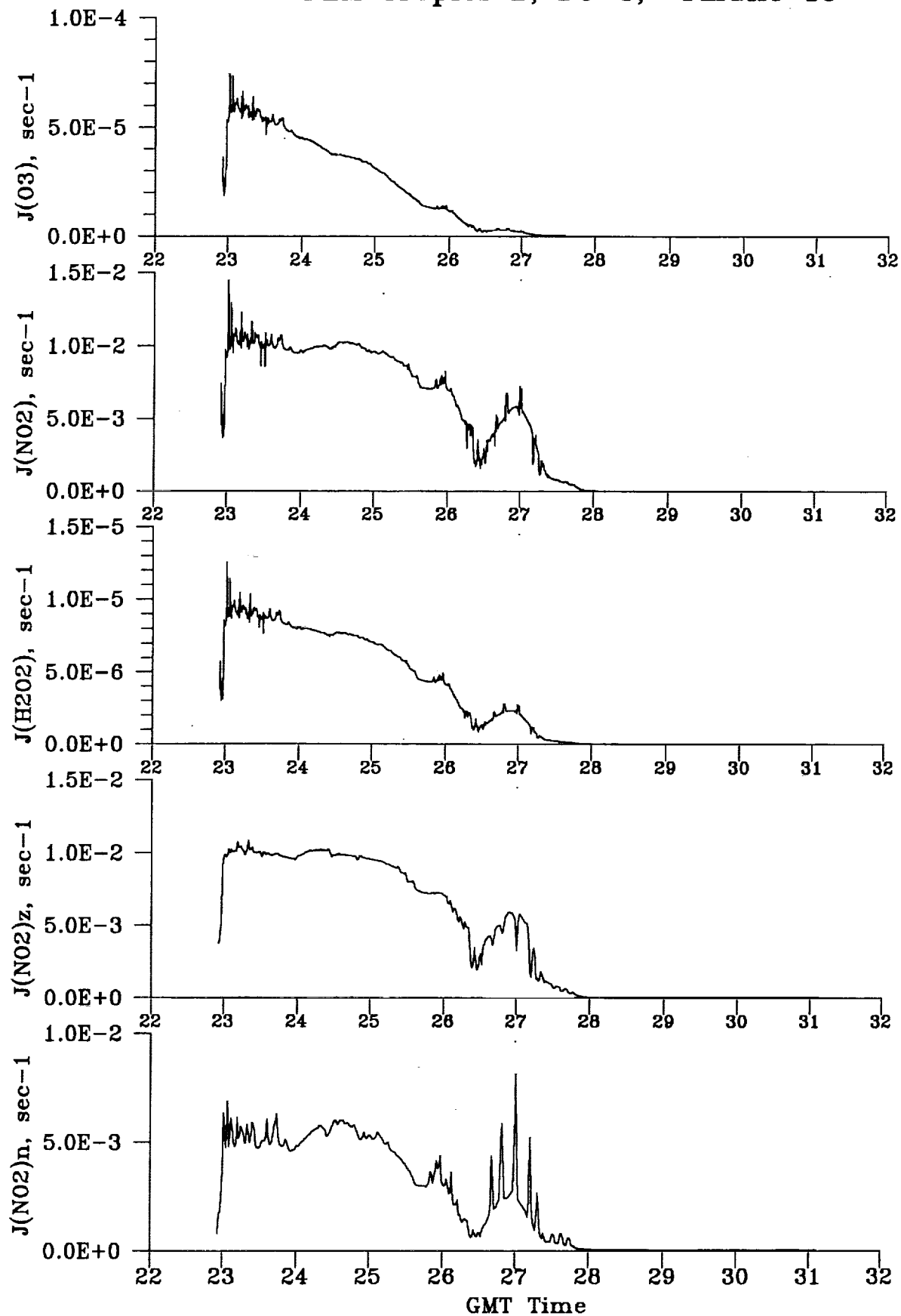
PEM Tropics B; DC-8; FLIGHT 16



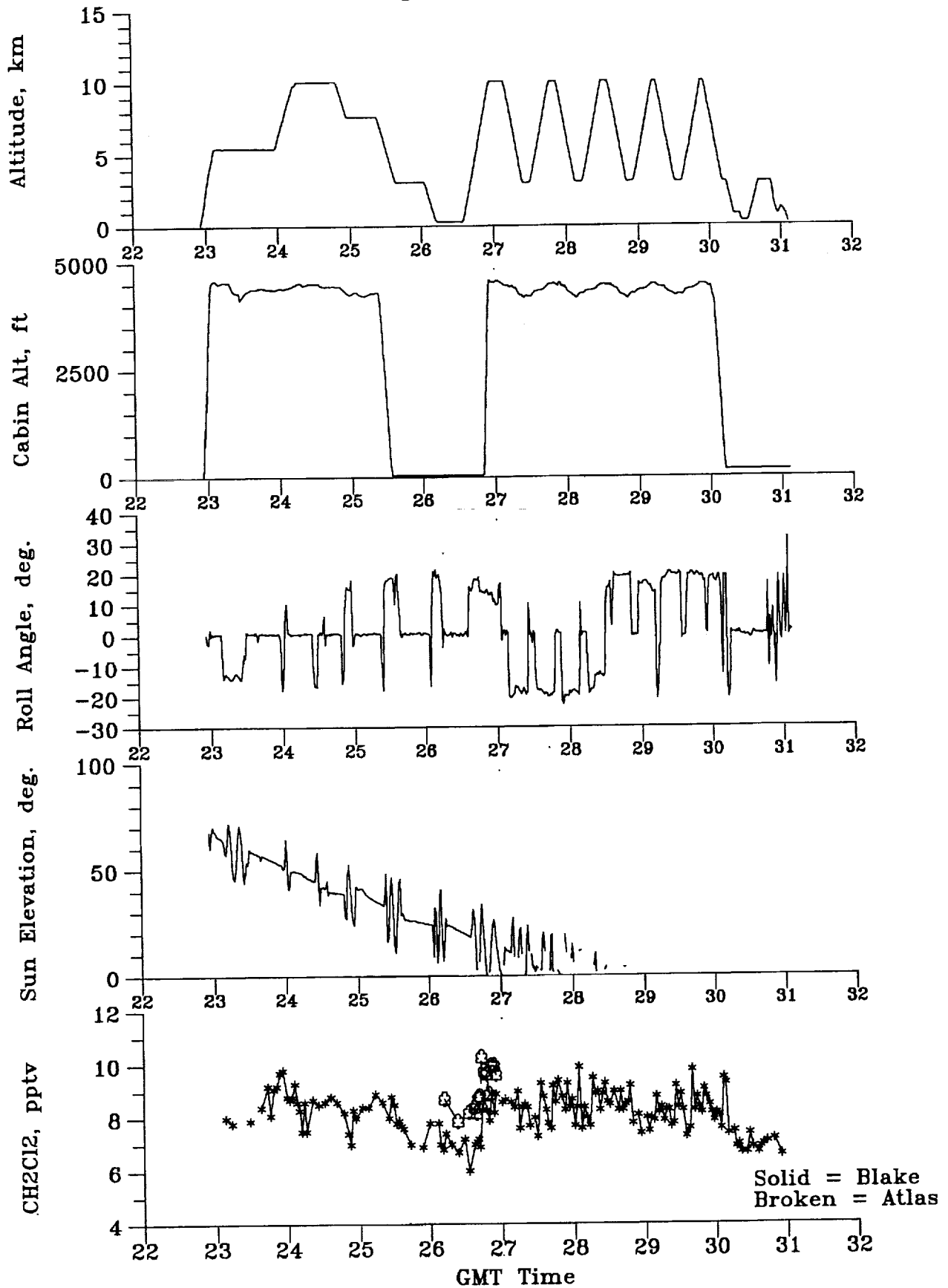
PEM Tropics B; DC-8; FLIGHT 16



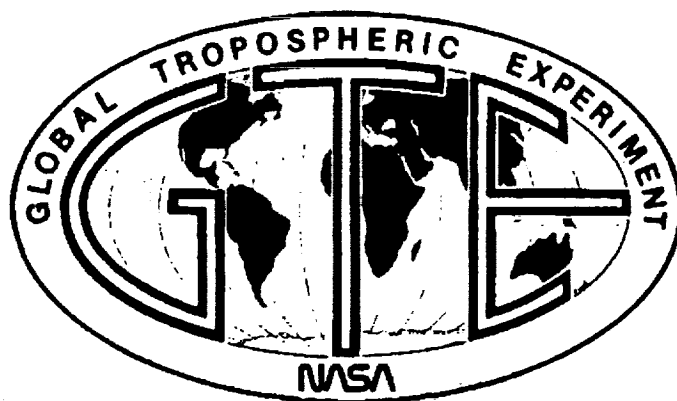
PEM Tropics B; DC-8; FLIGHT 16



PEM Tropics B; DC-8; FLIGHT 16



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

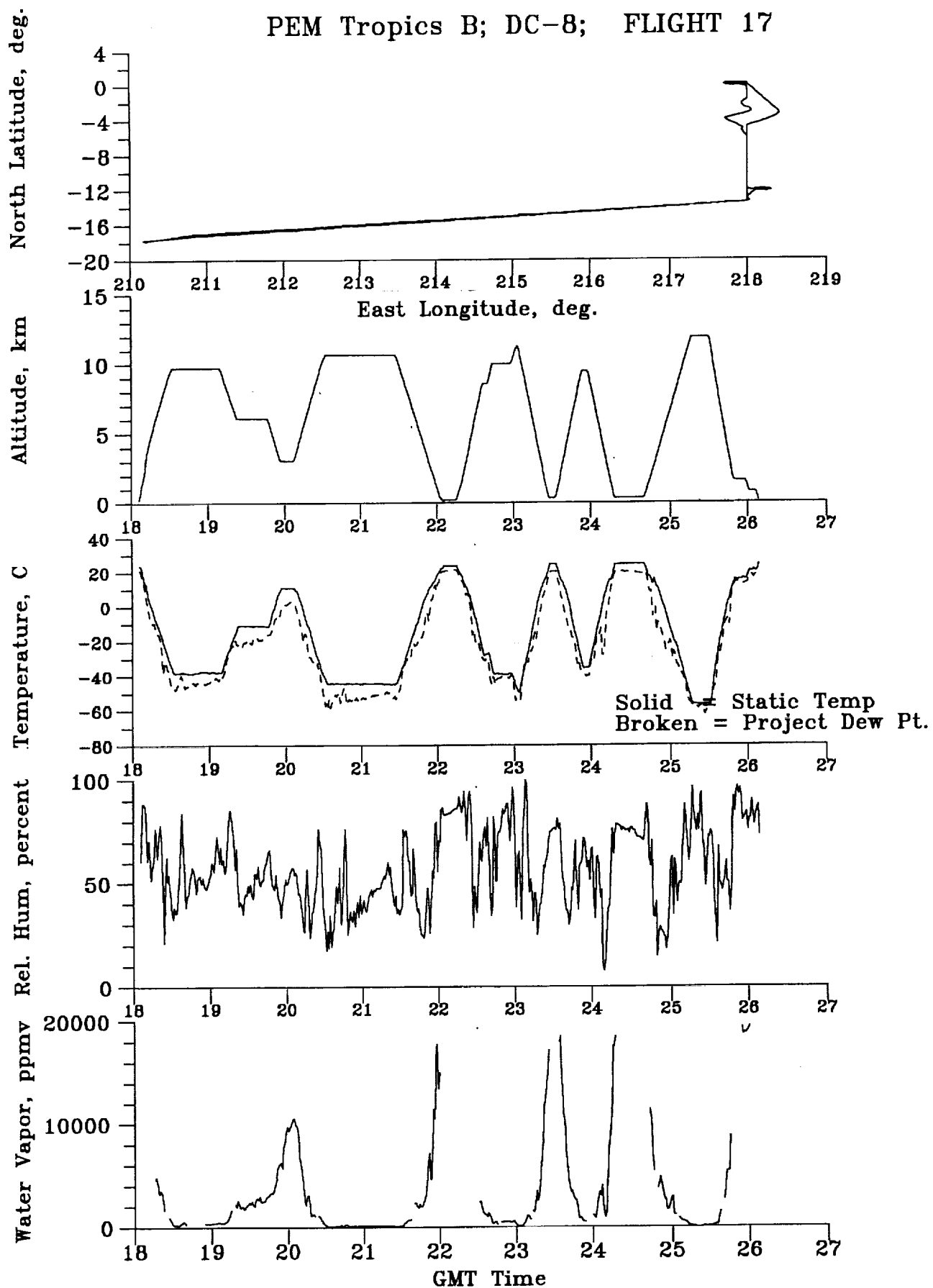
Flight 17D

Local: Tahiti No. 4

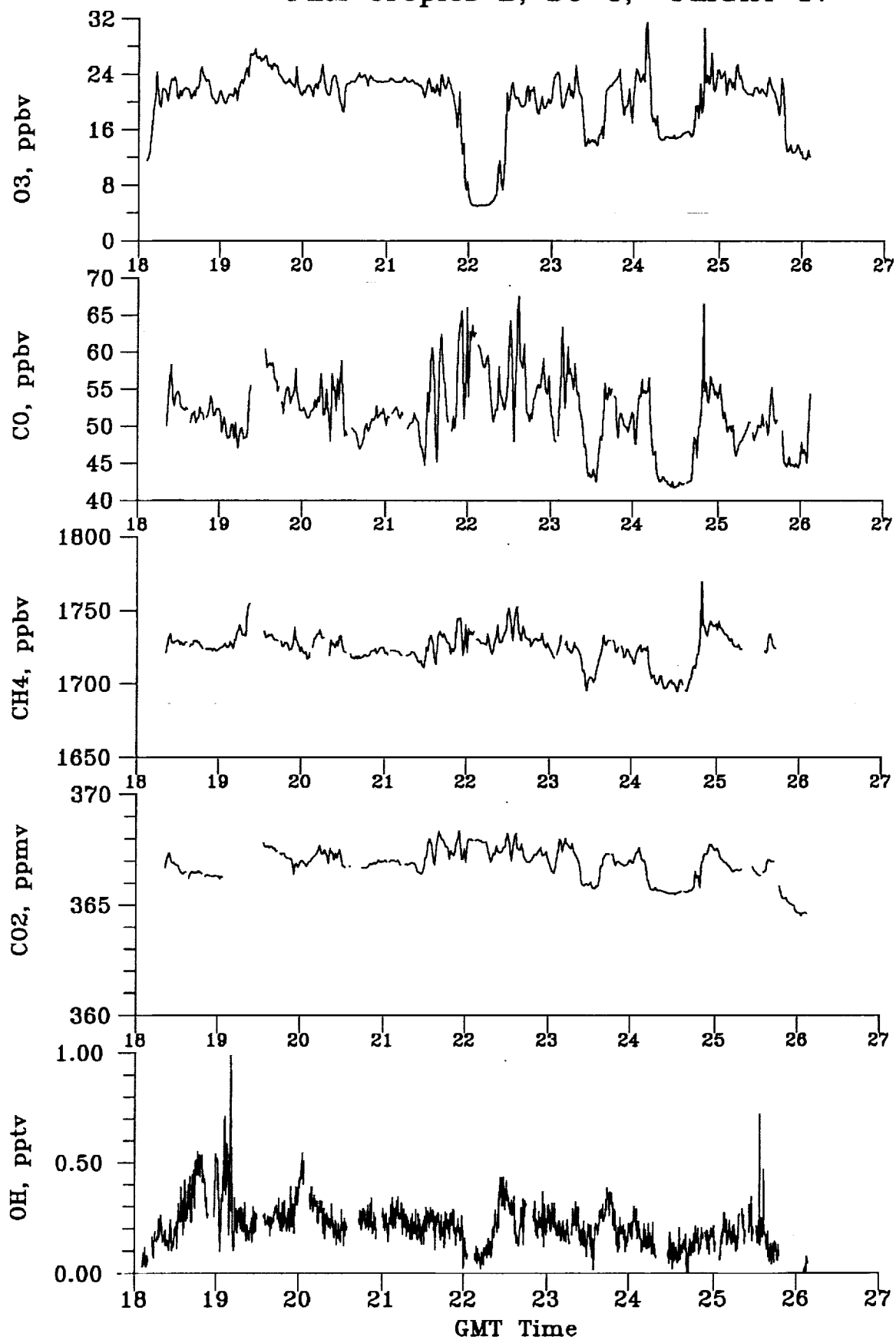
ITCZ Inflow/Outflow

April 7, 1999

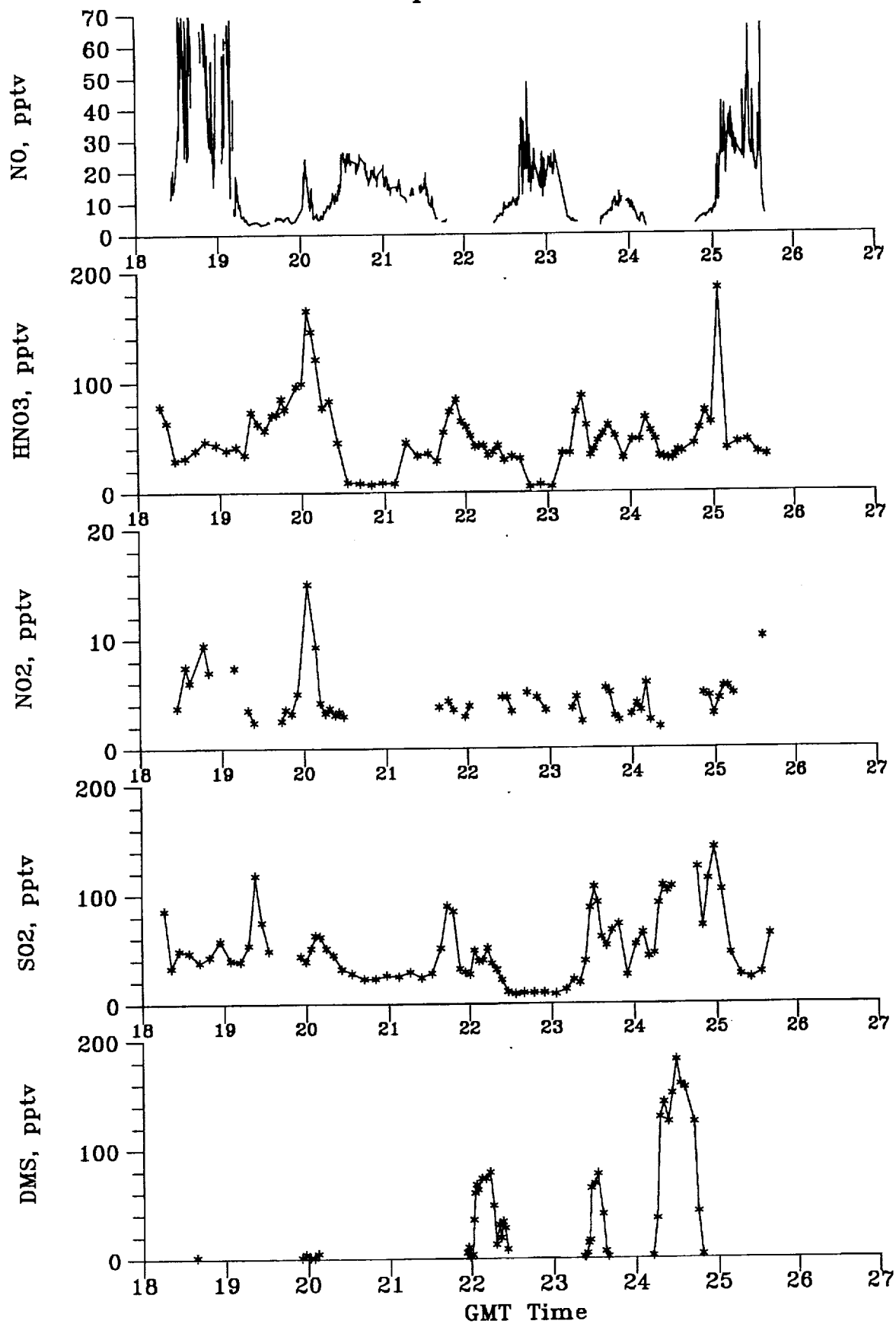
PEM Tropics B; DC-8; FLIGHT 17



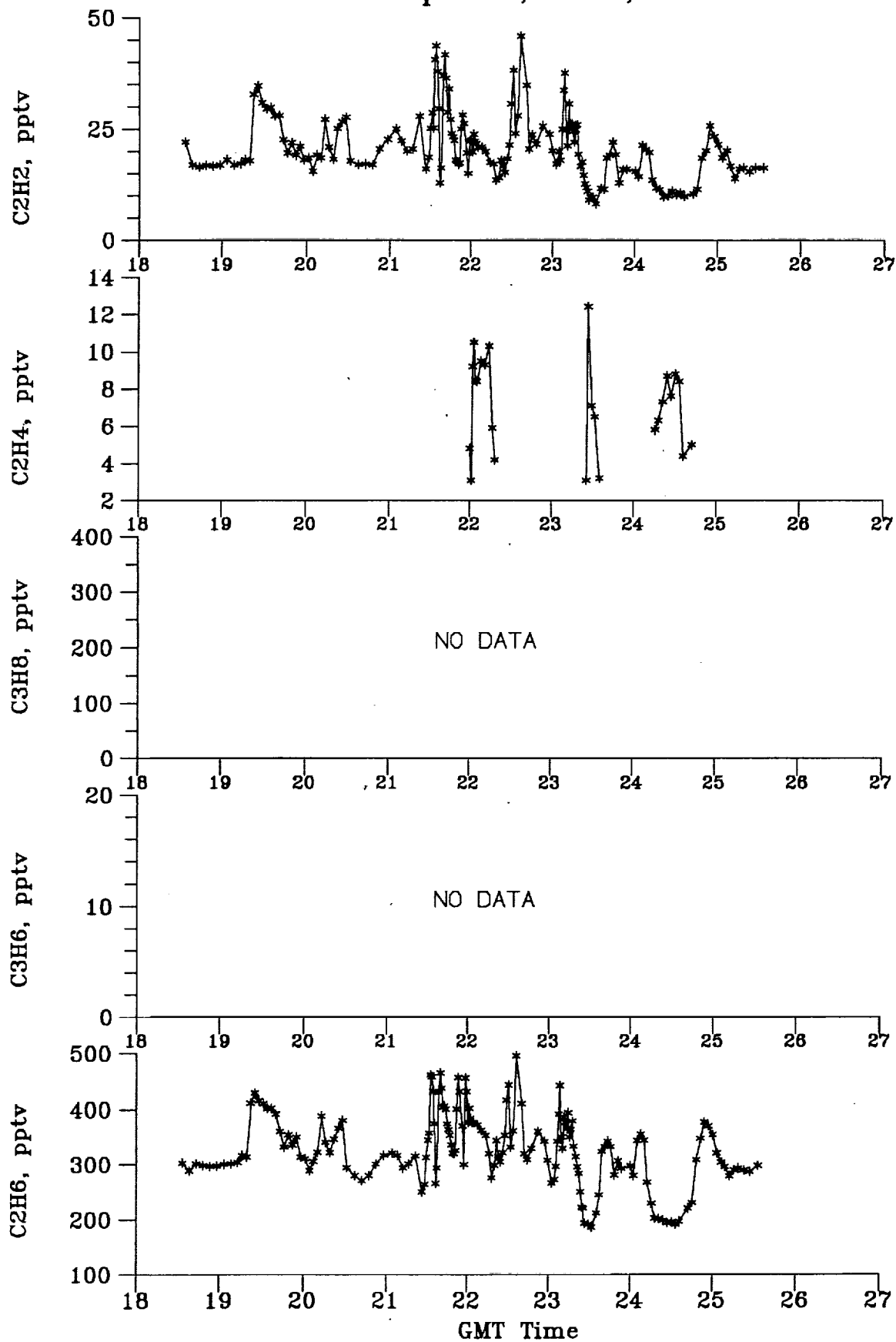
PEM Tropics B; DC-8; FLIGHT 17



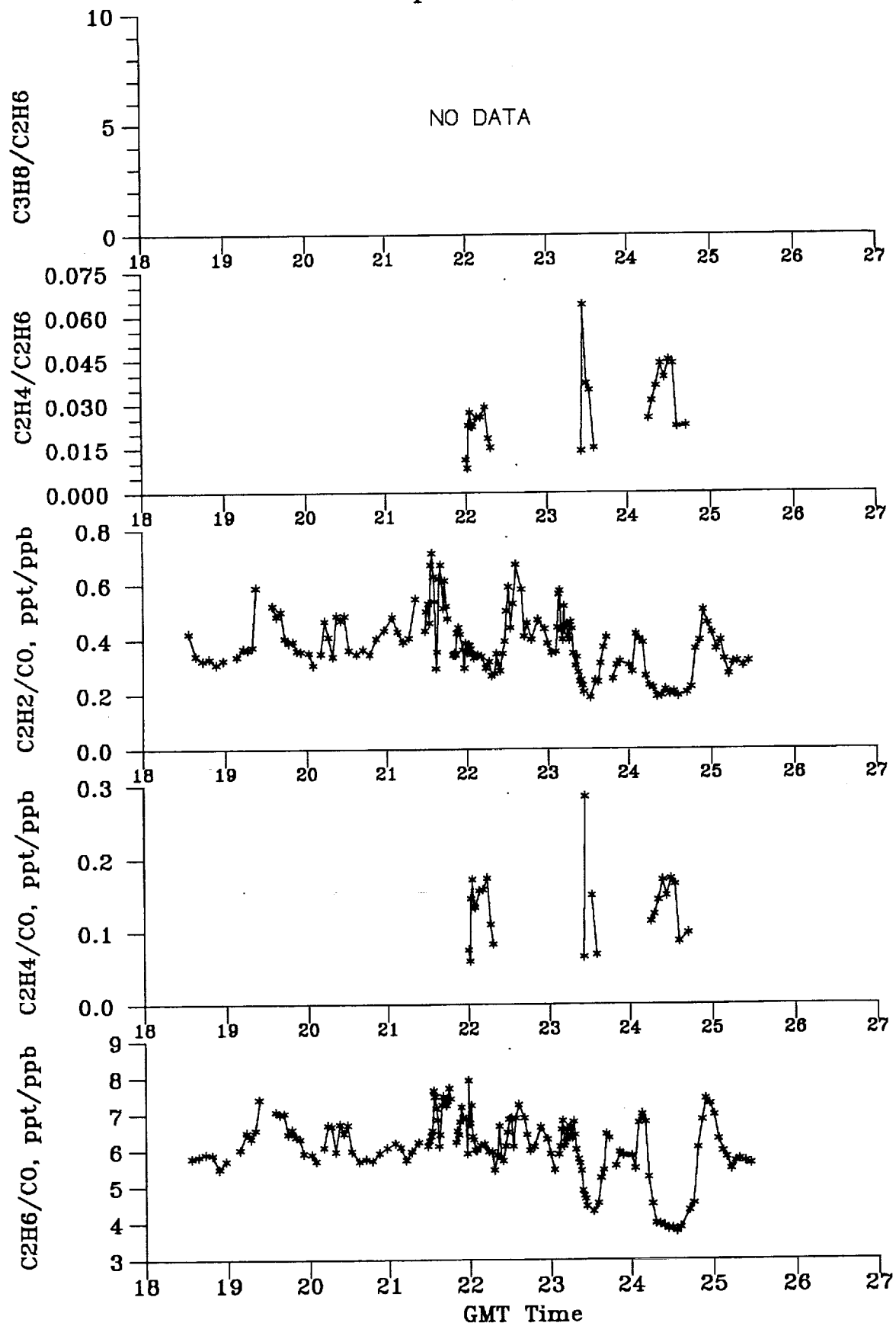
PEM Tropics B; DC-8; FLIGHT 17



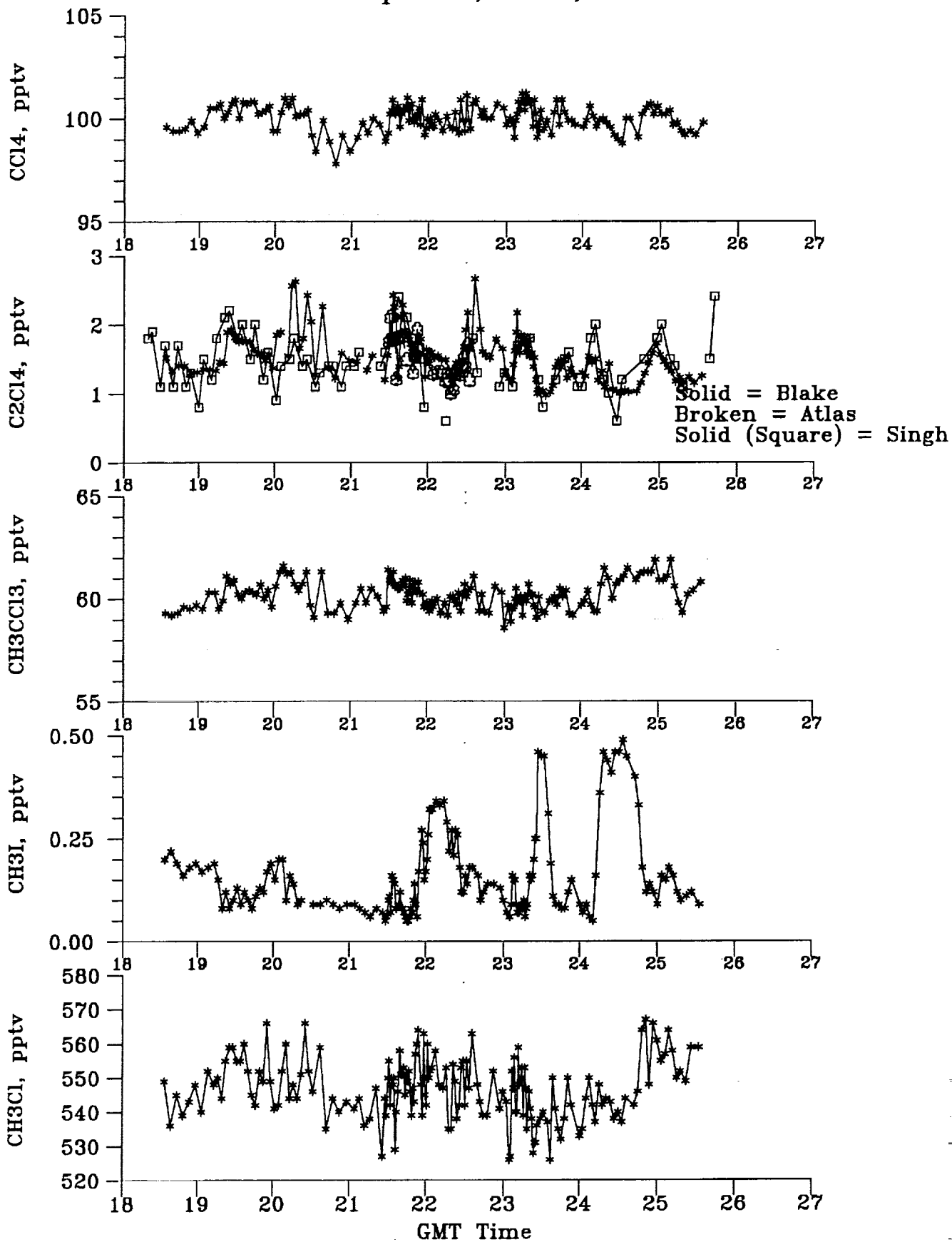
PEM Tropics B; DC-8; FLIGHT 17



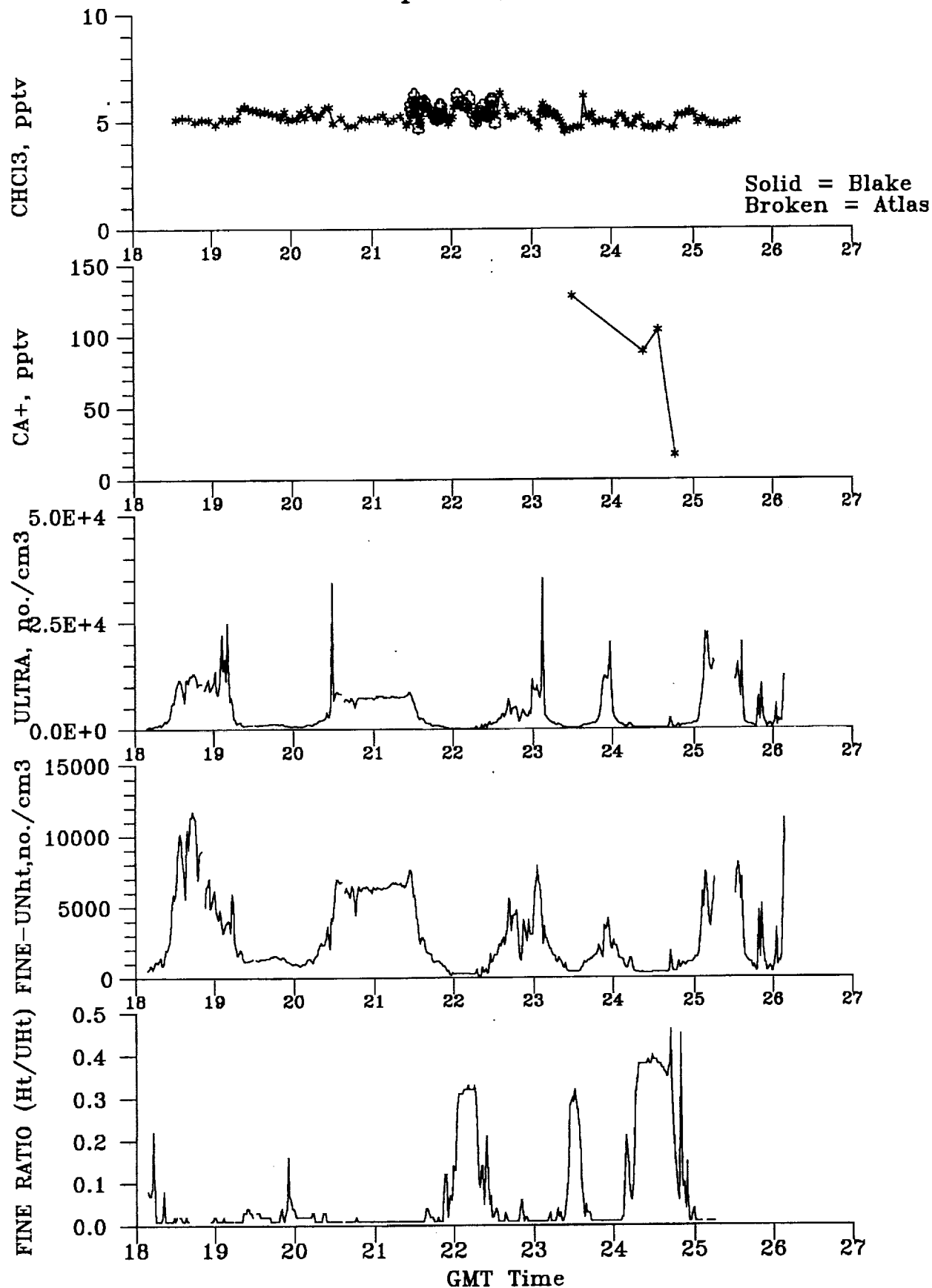
PEM Tropics B; DC-8; FLIGHT 17



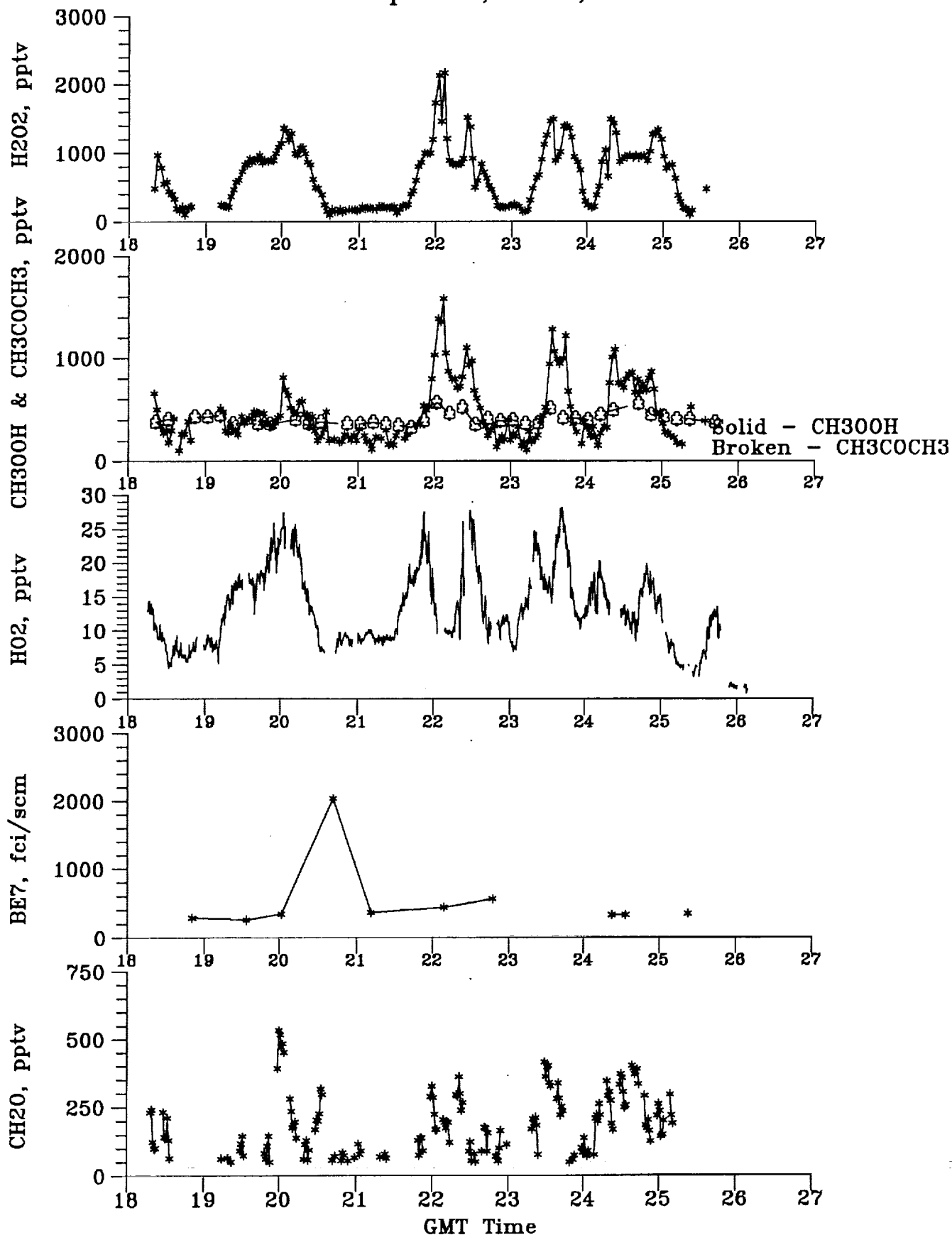
PEM Tropics B; DC-8; FLIGHT 17



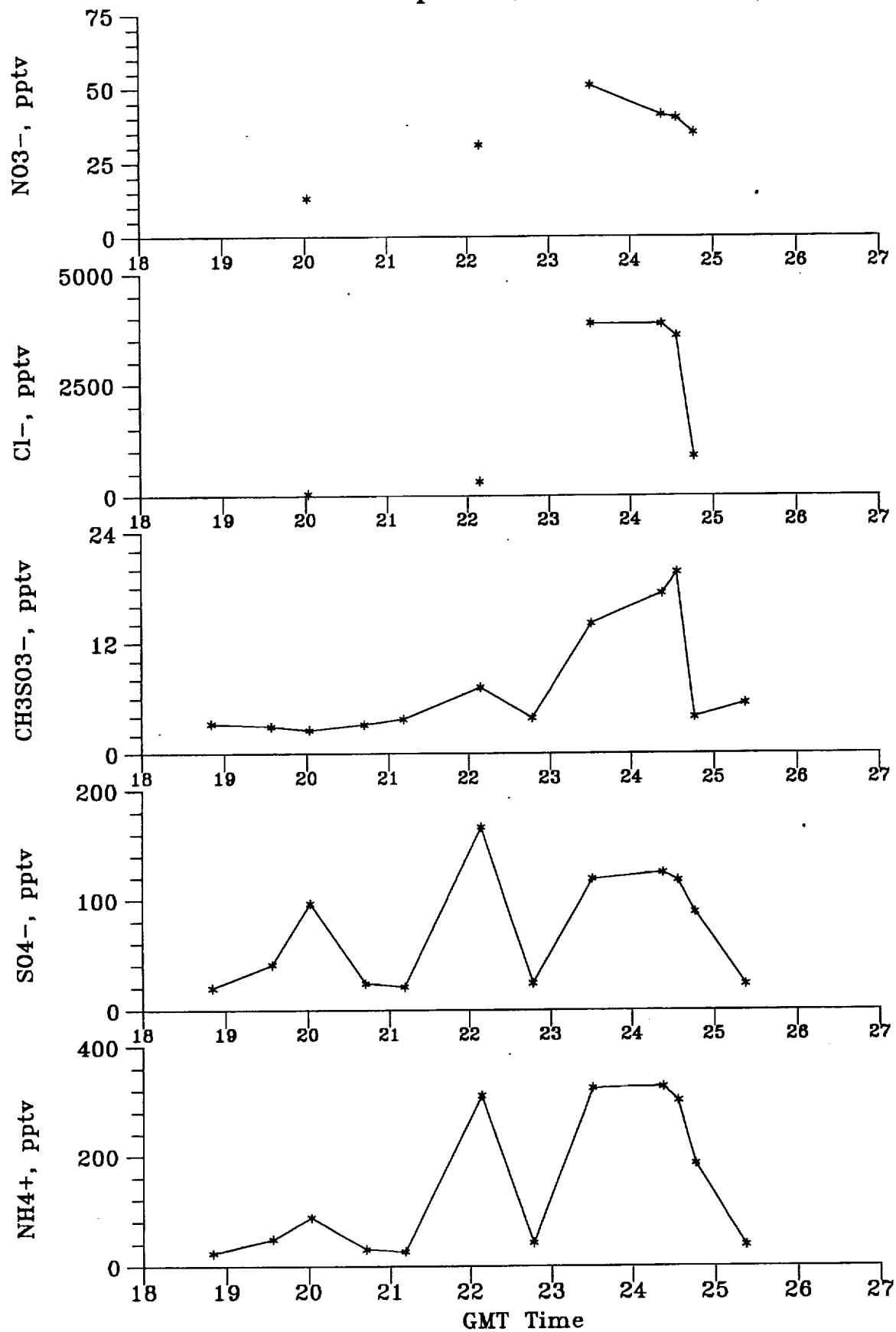
PEM Tropics B; DC-8; FLIGHT 17



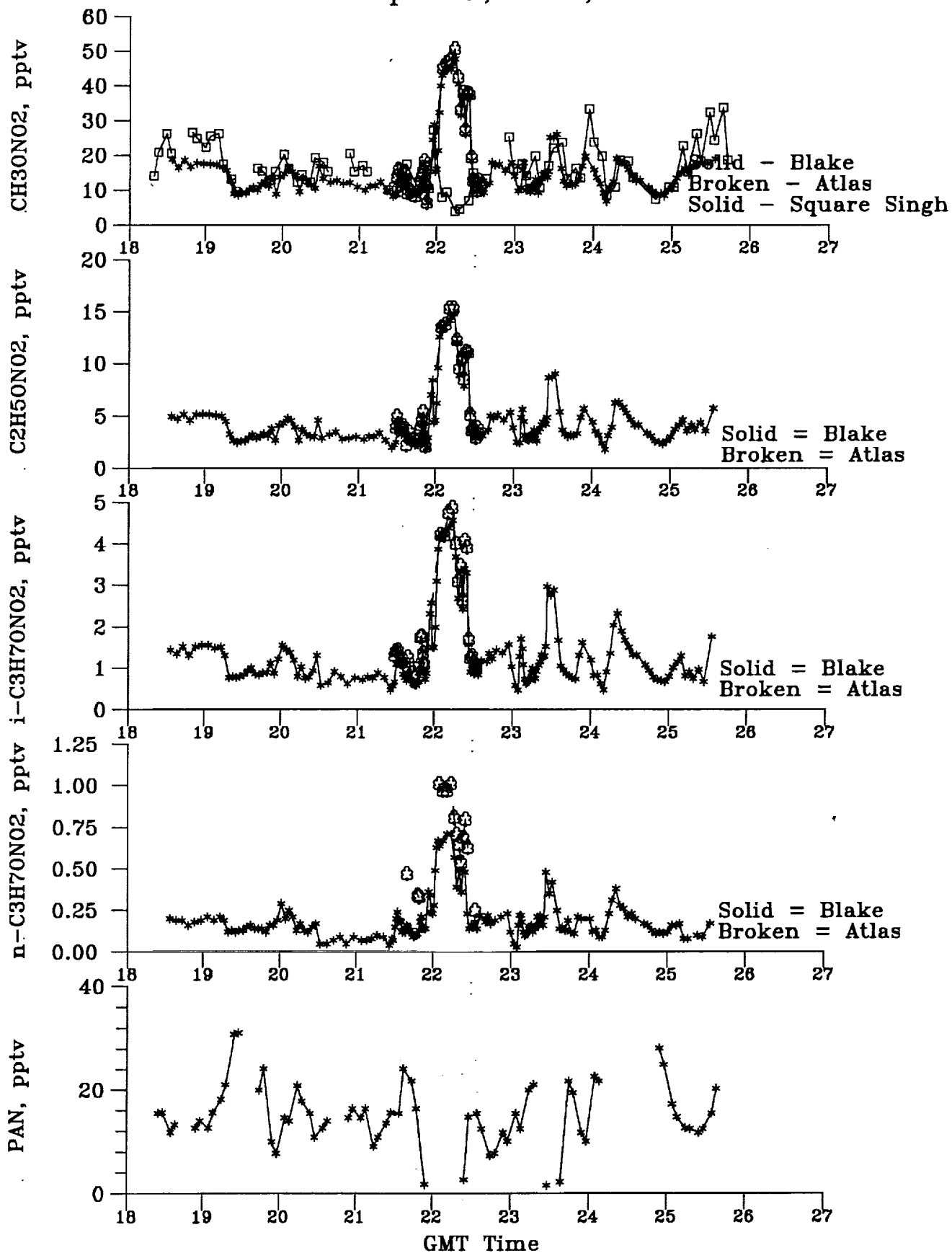
PEM Tropics B; DC-8; FLIGHT 17



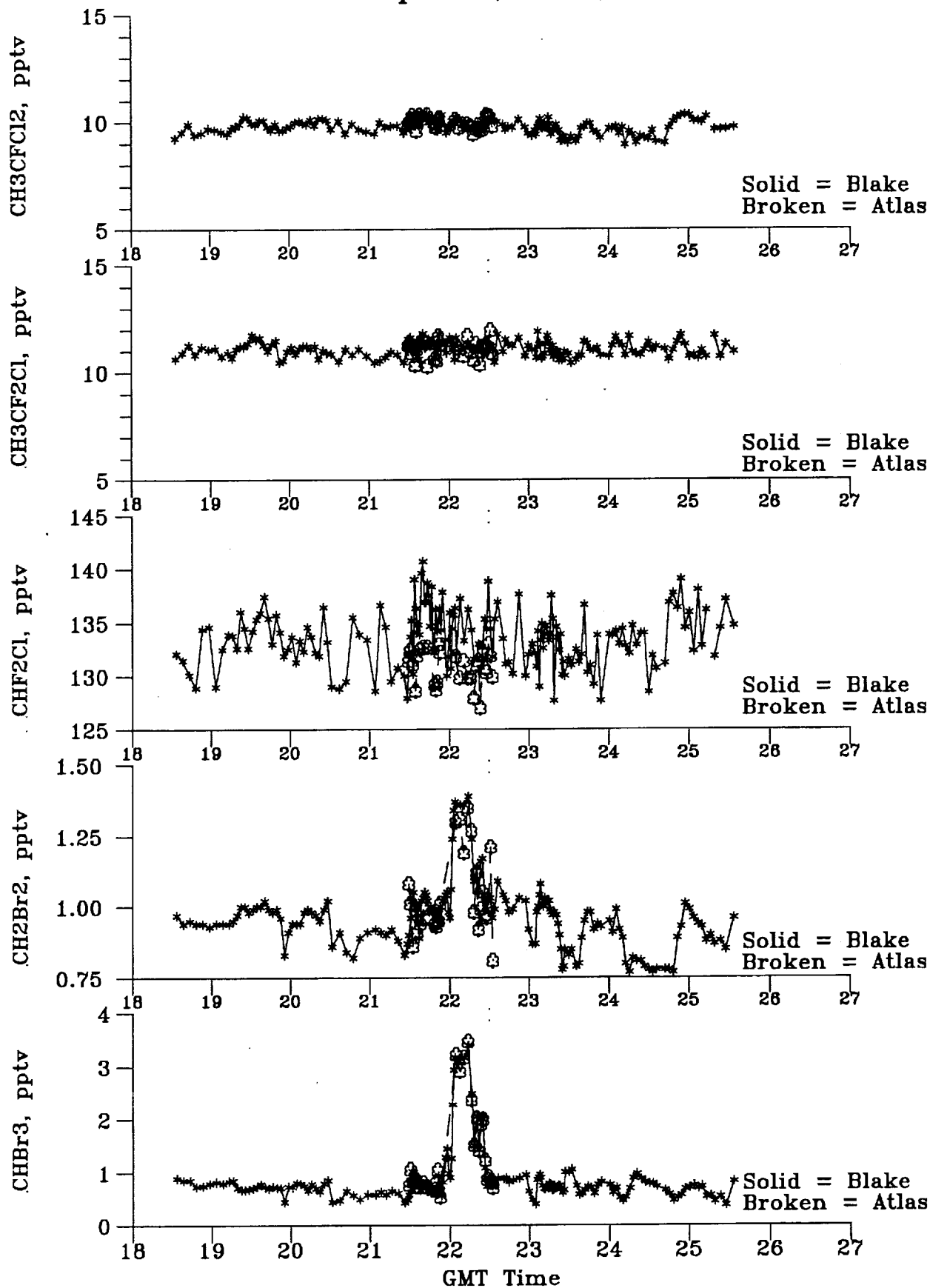
PEM Tropics B; DC-8; FLIGHT 17



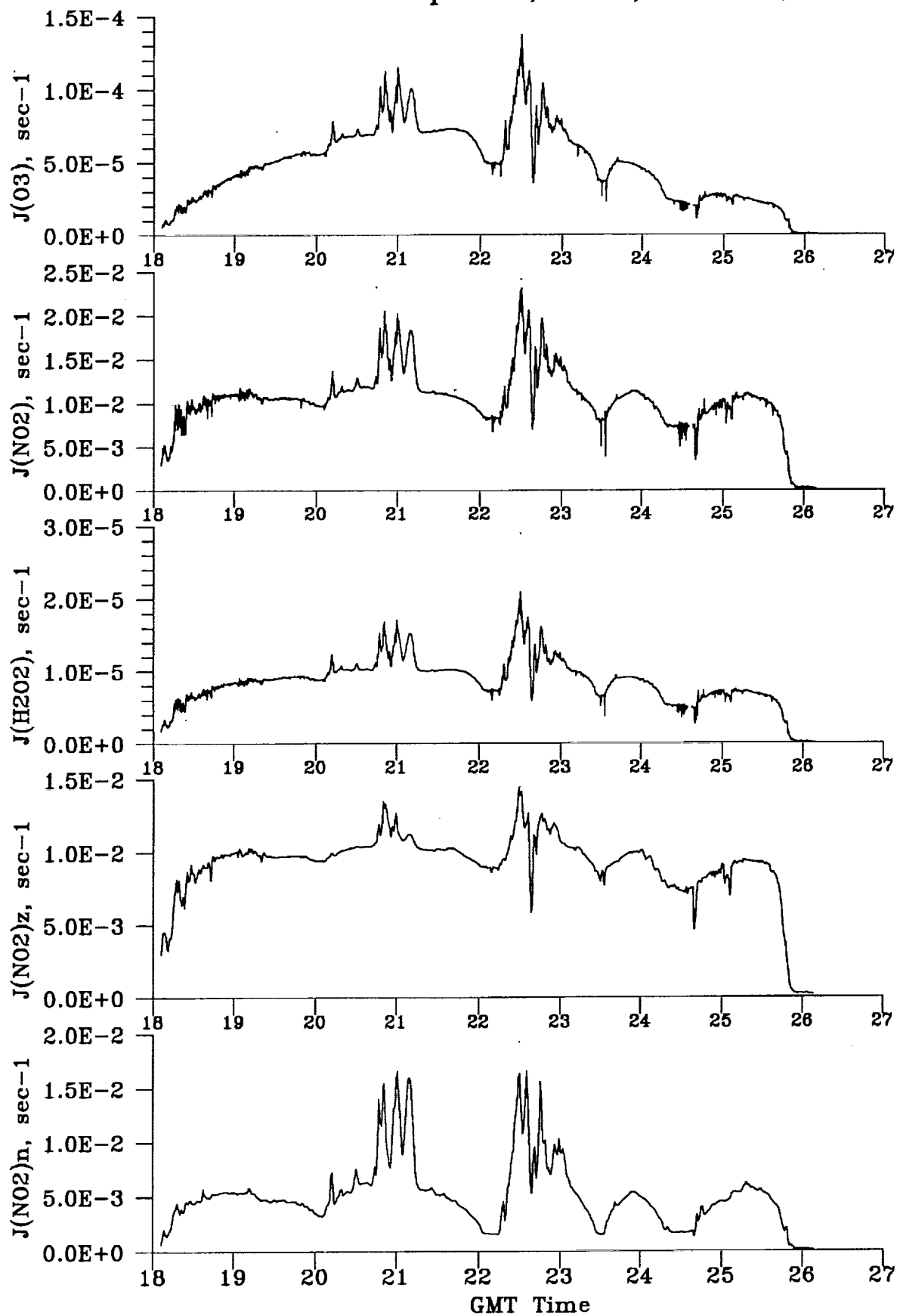
PEM Tropics B; DC-8; FLIGHT 17



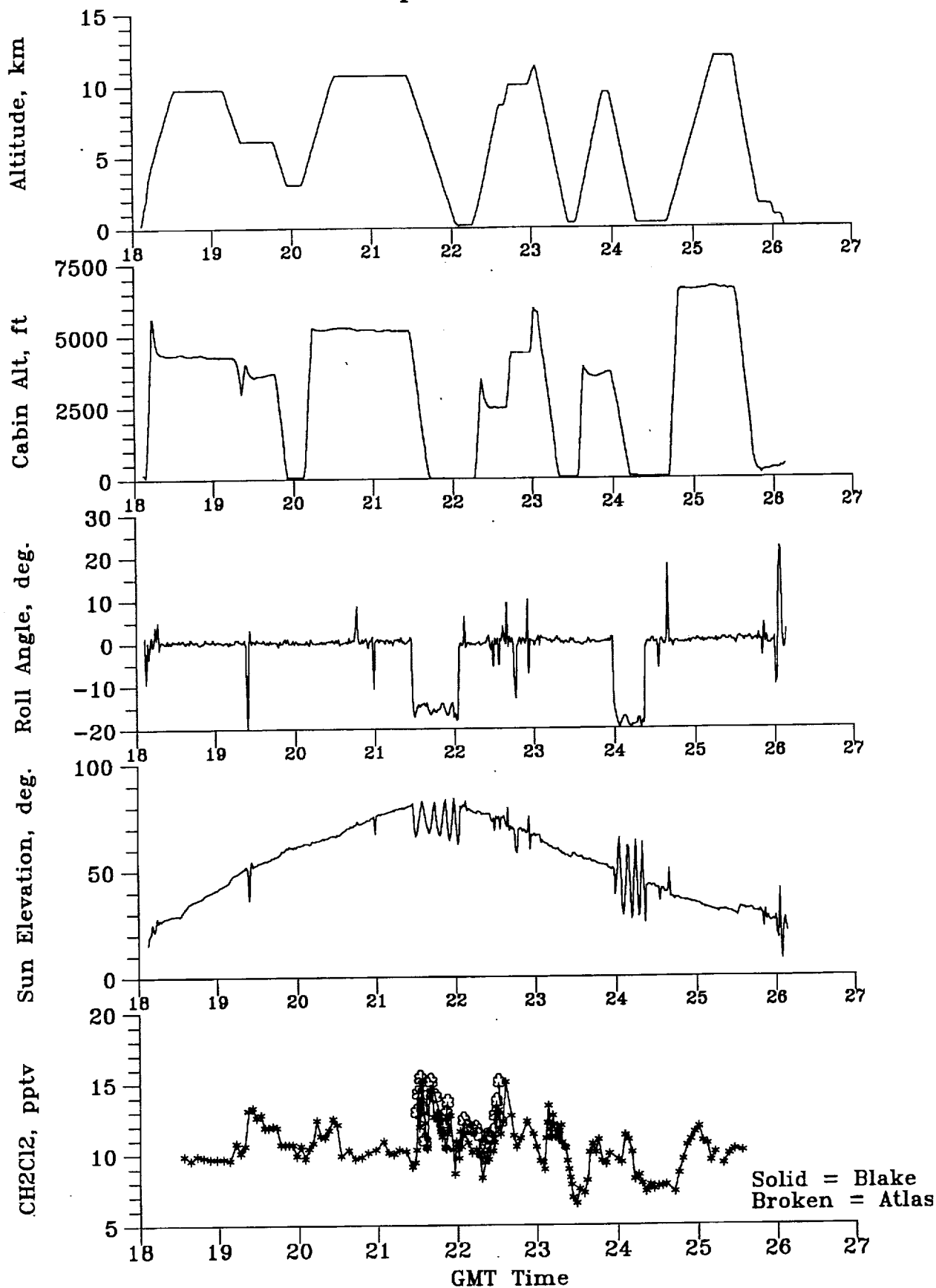
PEM Tropics B; DC-8; FLIGHT 17



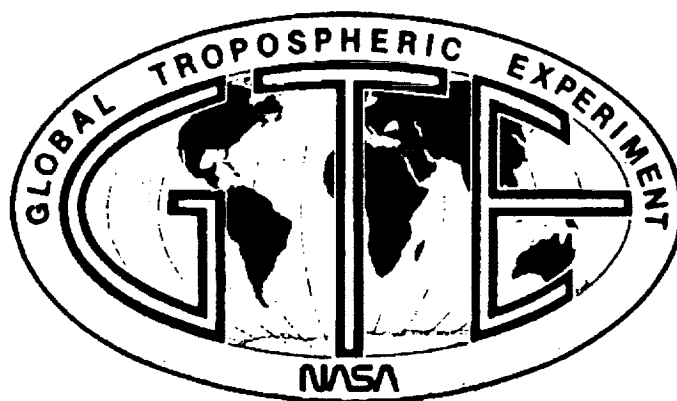
PEM Tropics B; DC-8; FLIGHT 17



PEM Tropics B; DC-8; FLIGHT 17



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

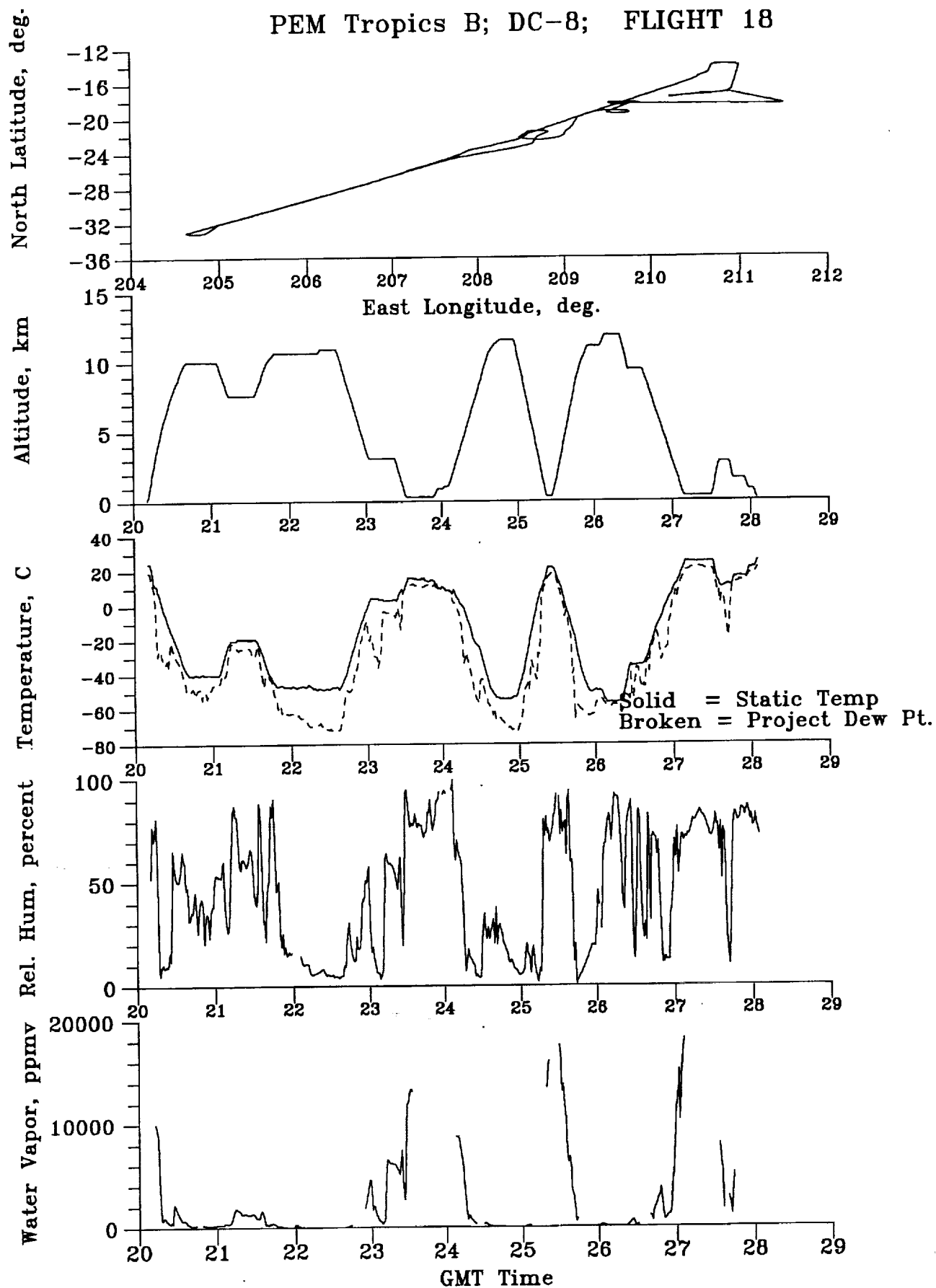
Flight 18D

Local: Tahiti No. 5

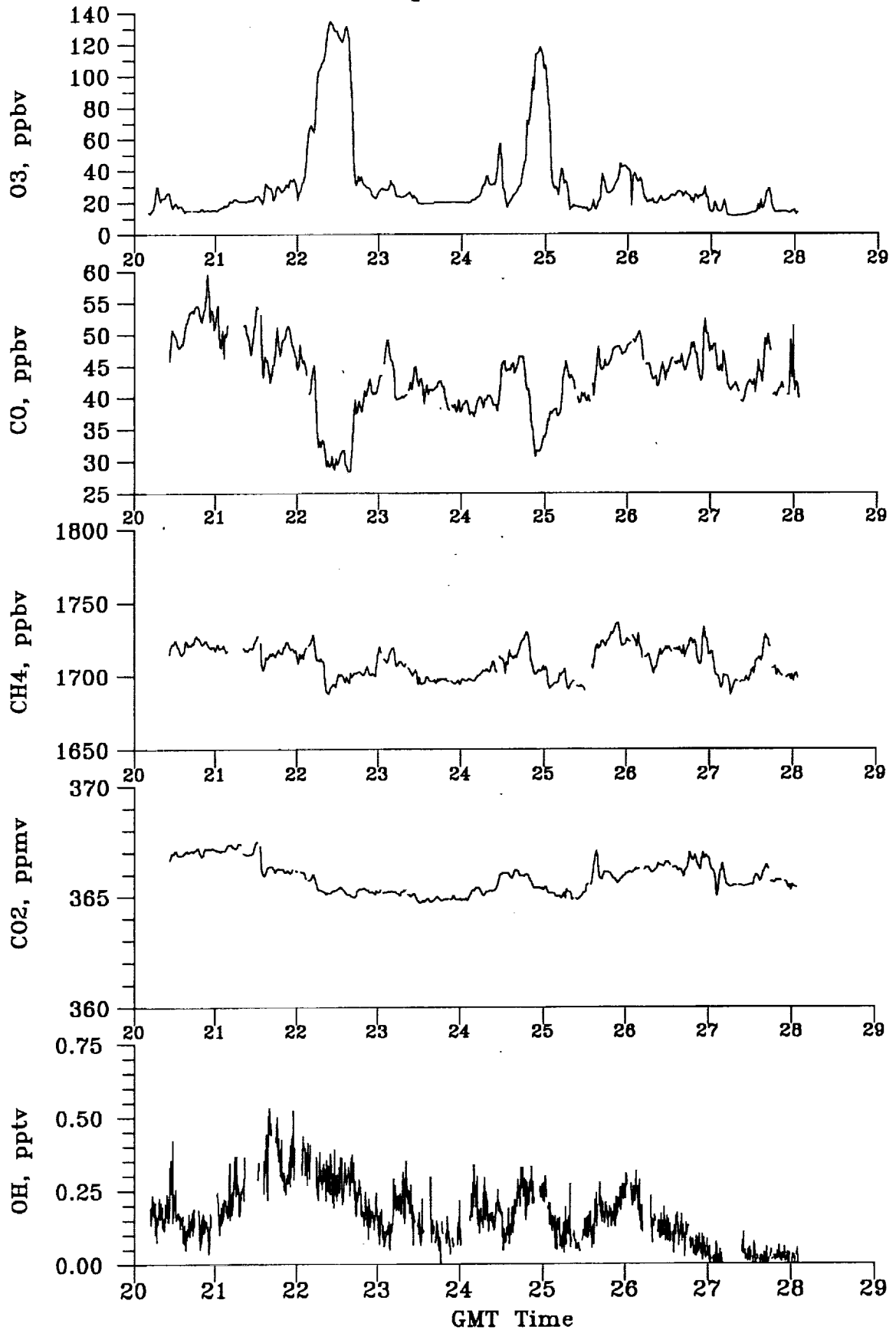
Frontal Crossing Characterization

April 10, 1999

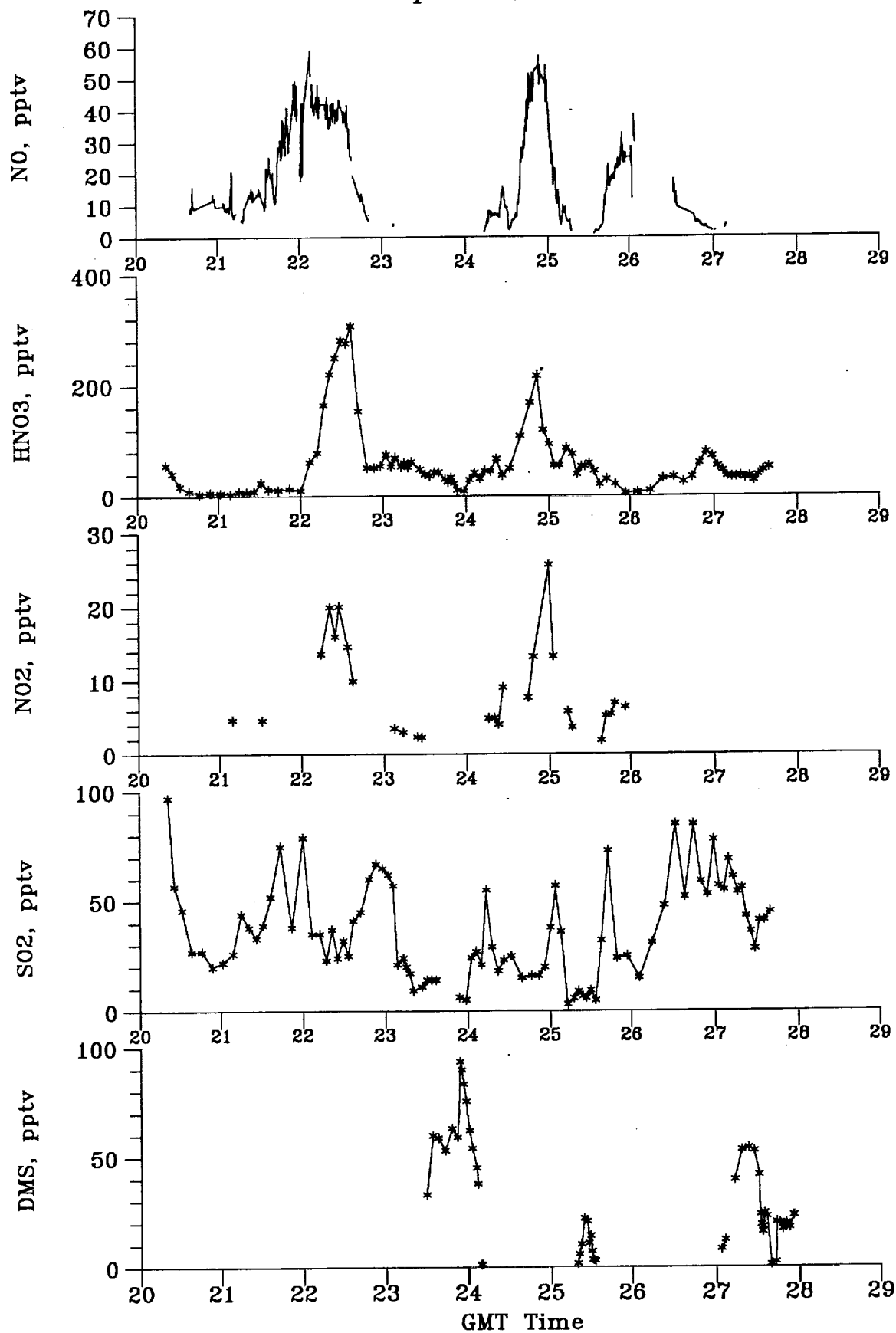
PEM Tropics B; DC-8; FLIGHT 18



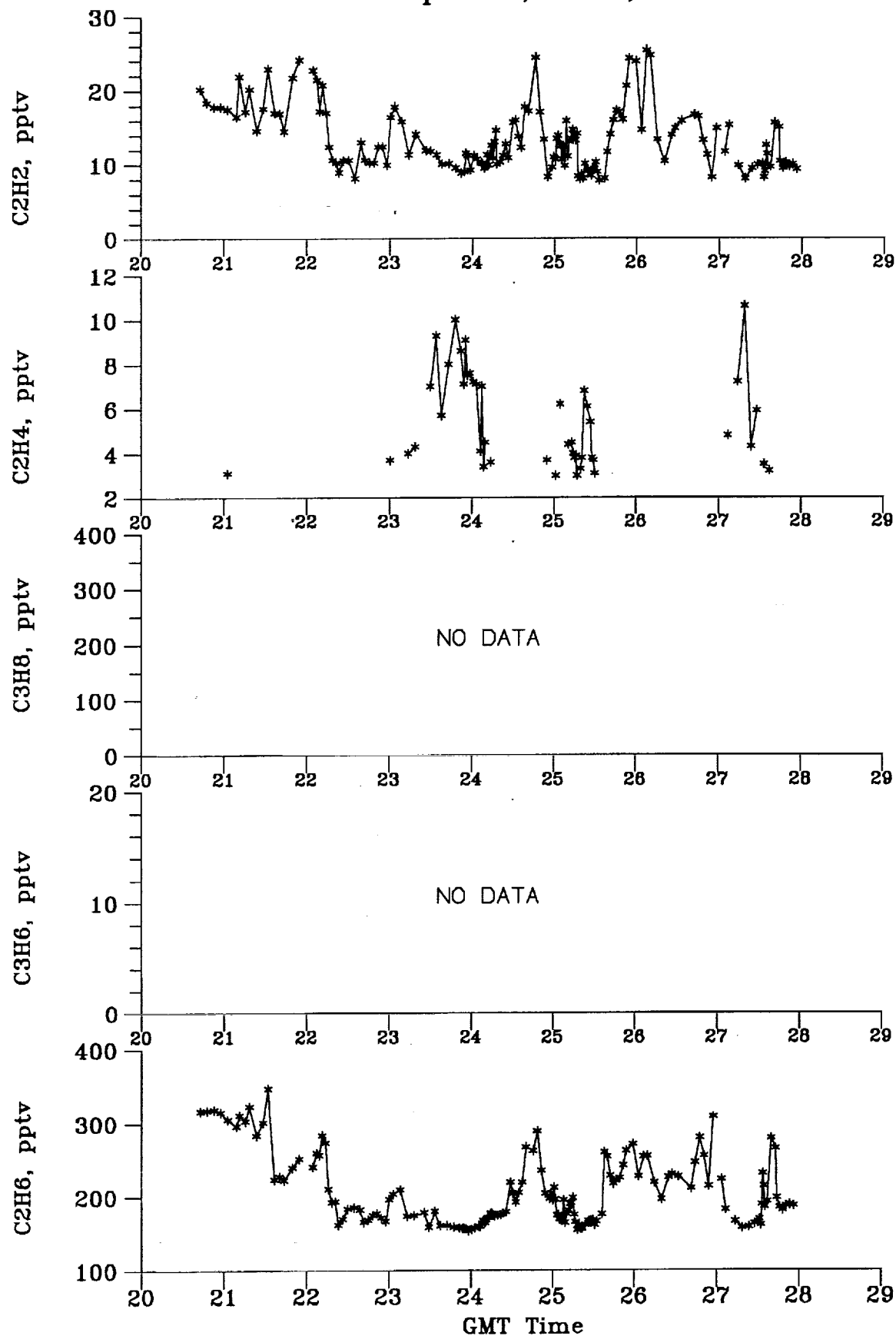
PEM Tropics B; DC-8; FLIGHT 18



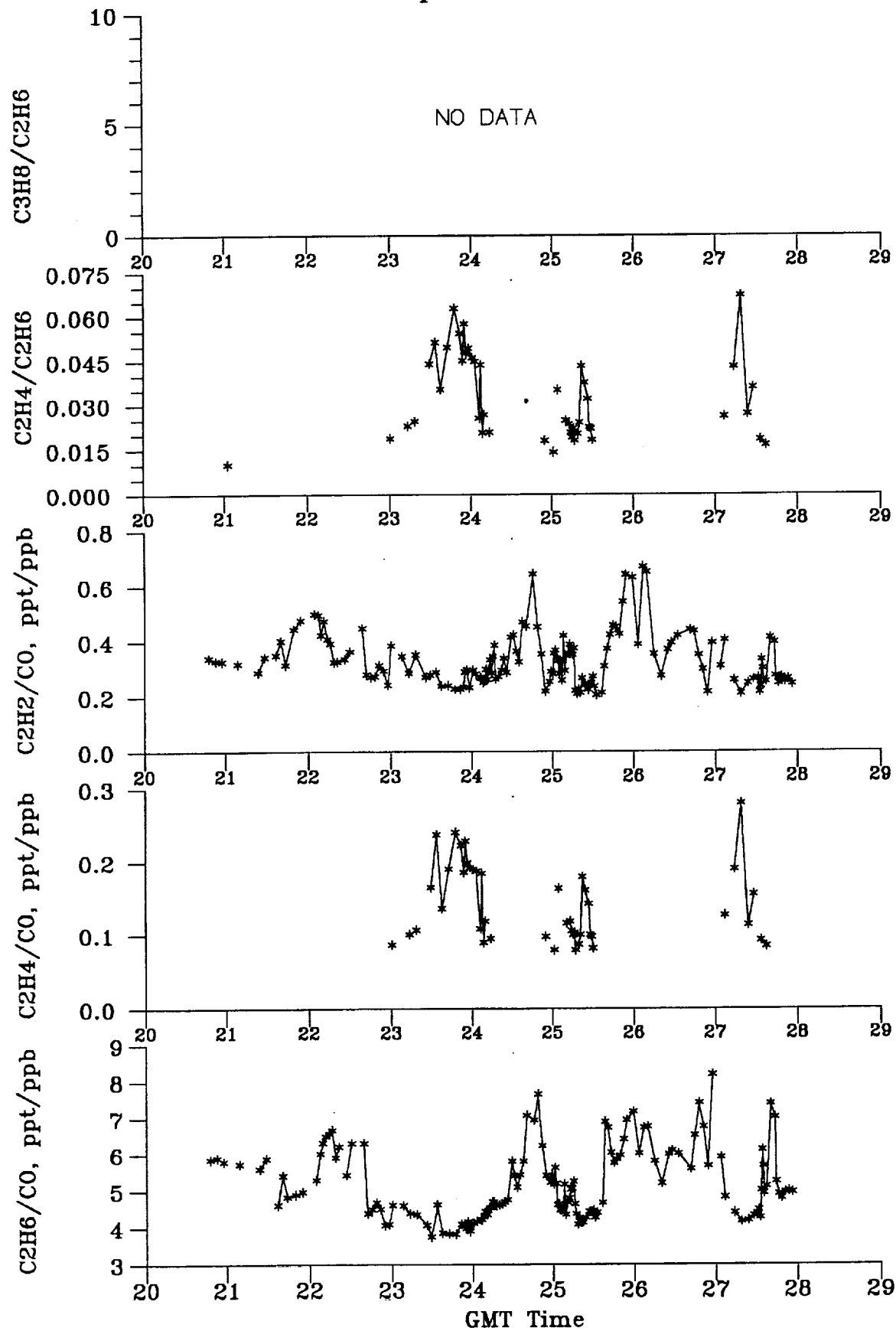
PEM Tropics B; DC-8; FLIGHT 18



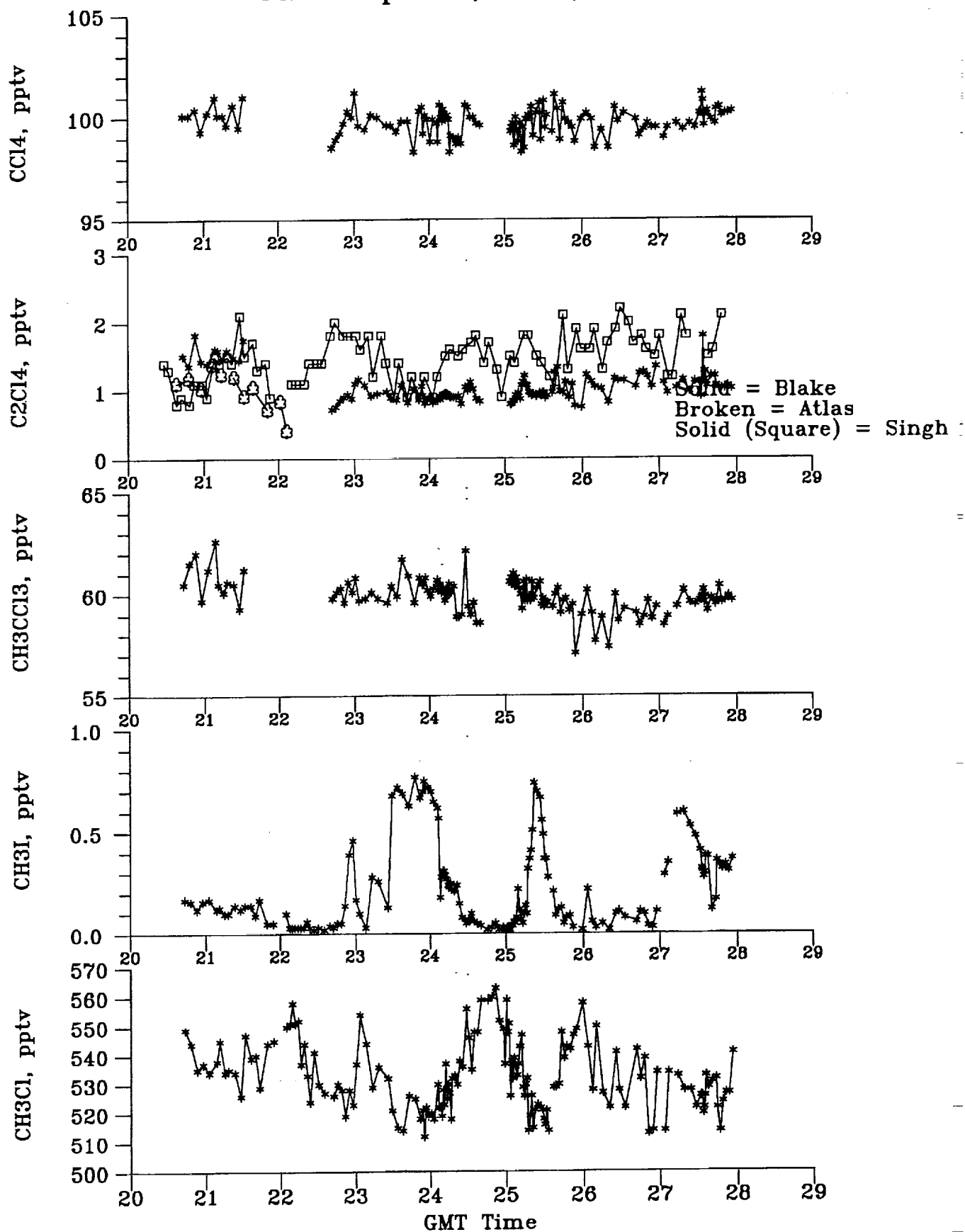
PEM Tropics B; DC-8; FLIGHT 18



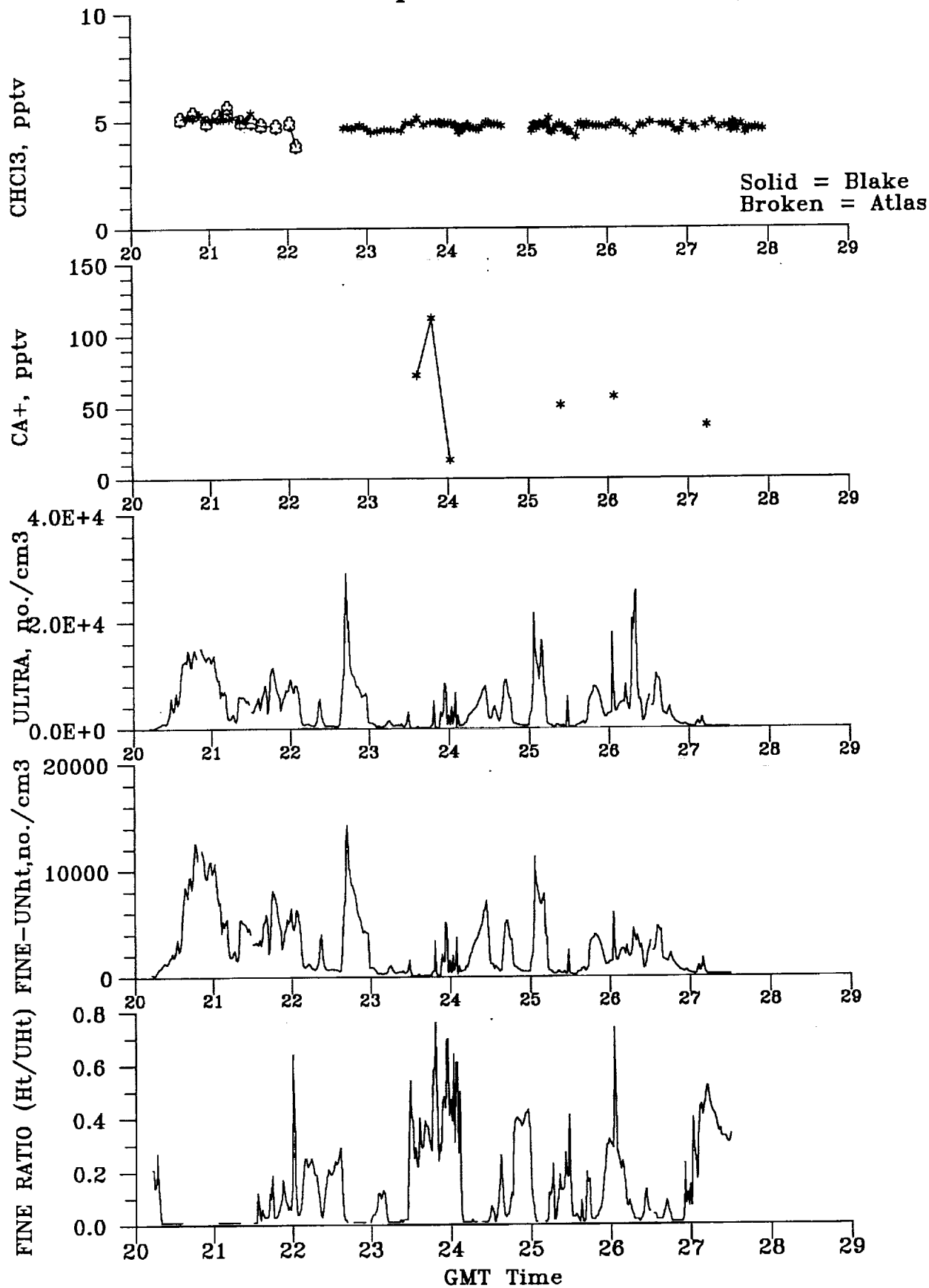
PEM Tropics B; DC-8; FLIGHT 18



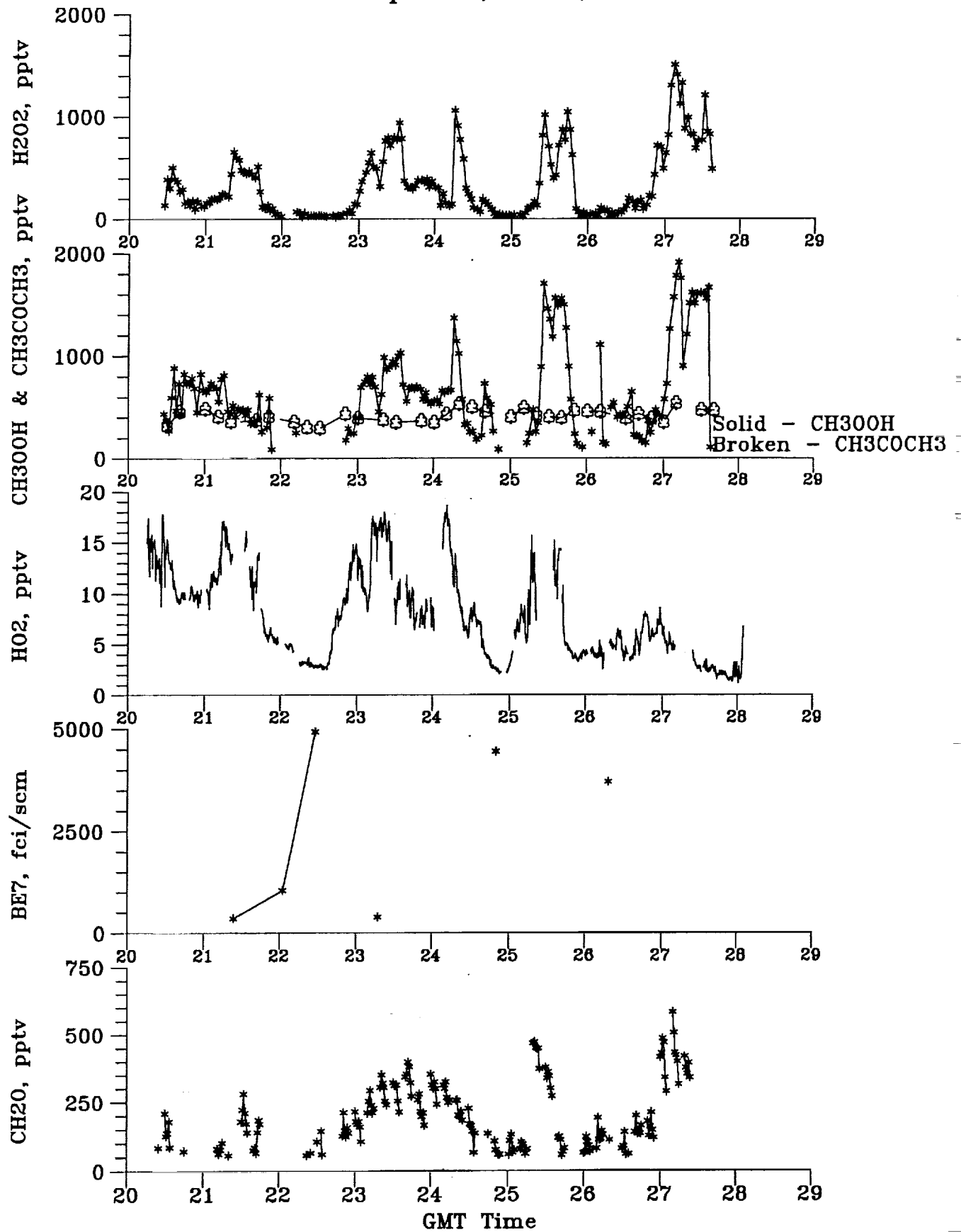
PEM Tropics B; DC-8; FLIGHT 18



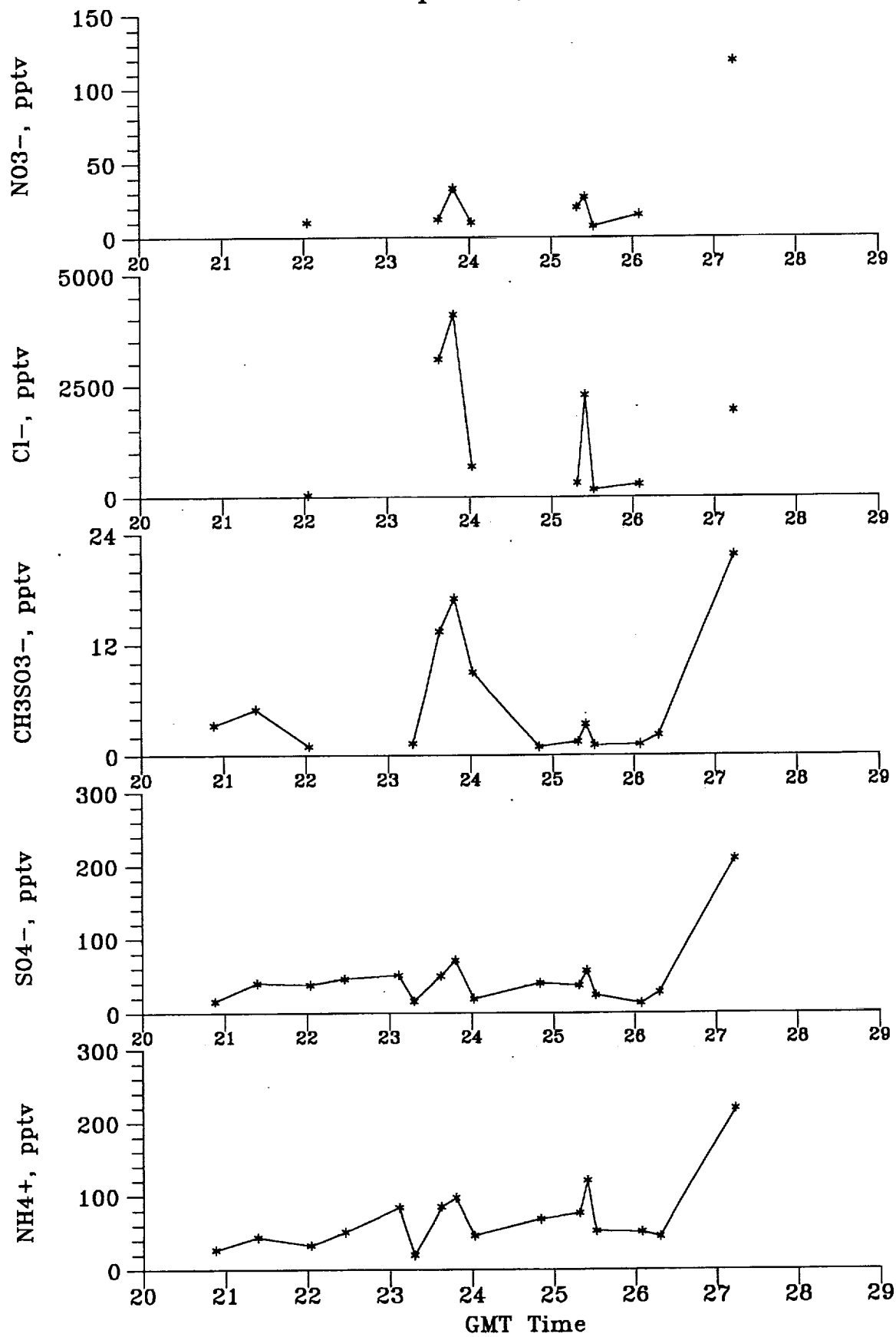
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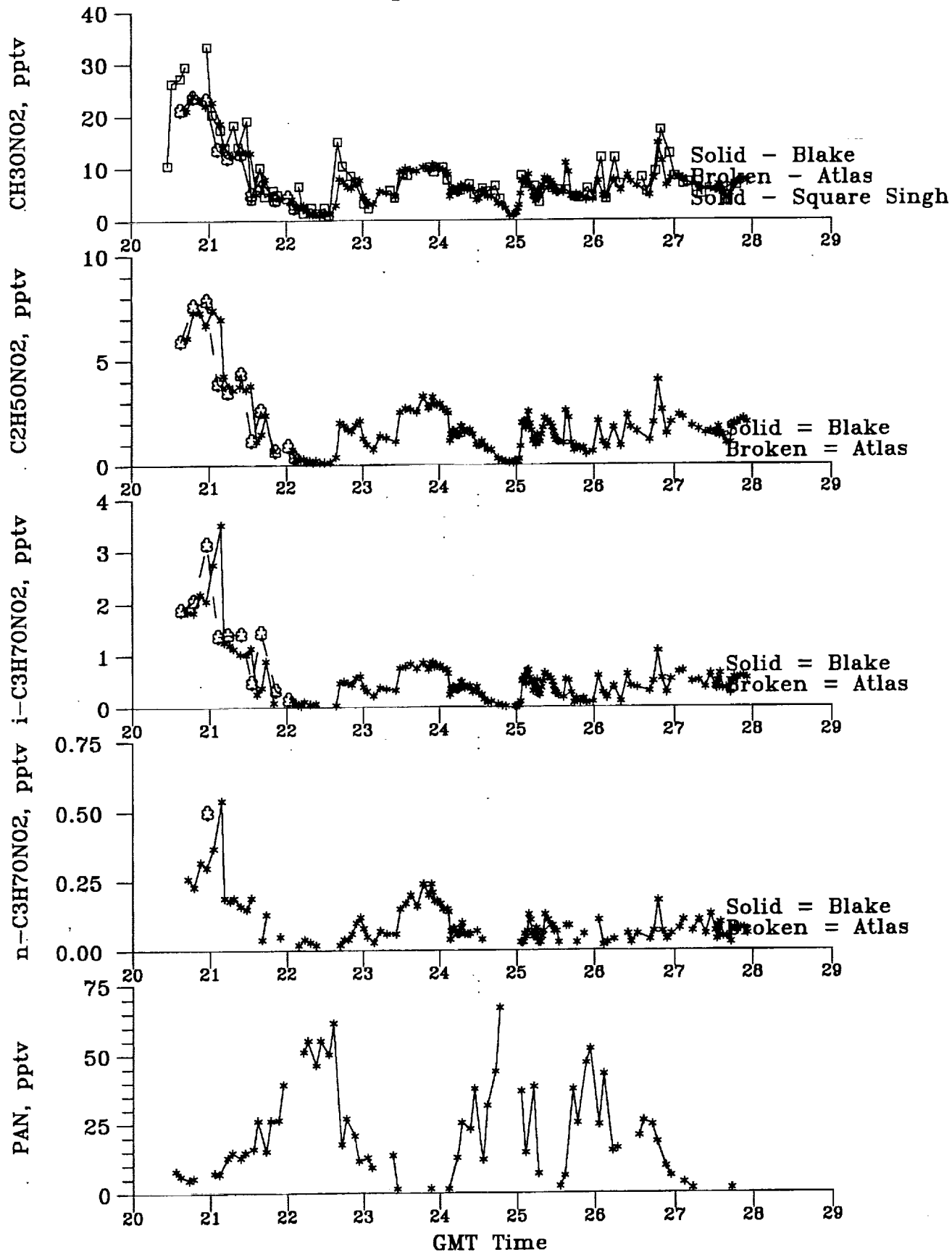
PEM Tropics B; DC-8; FLIGHT 18



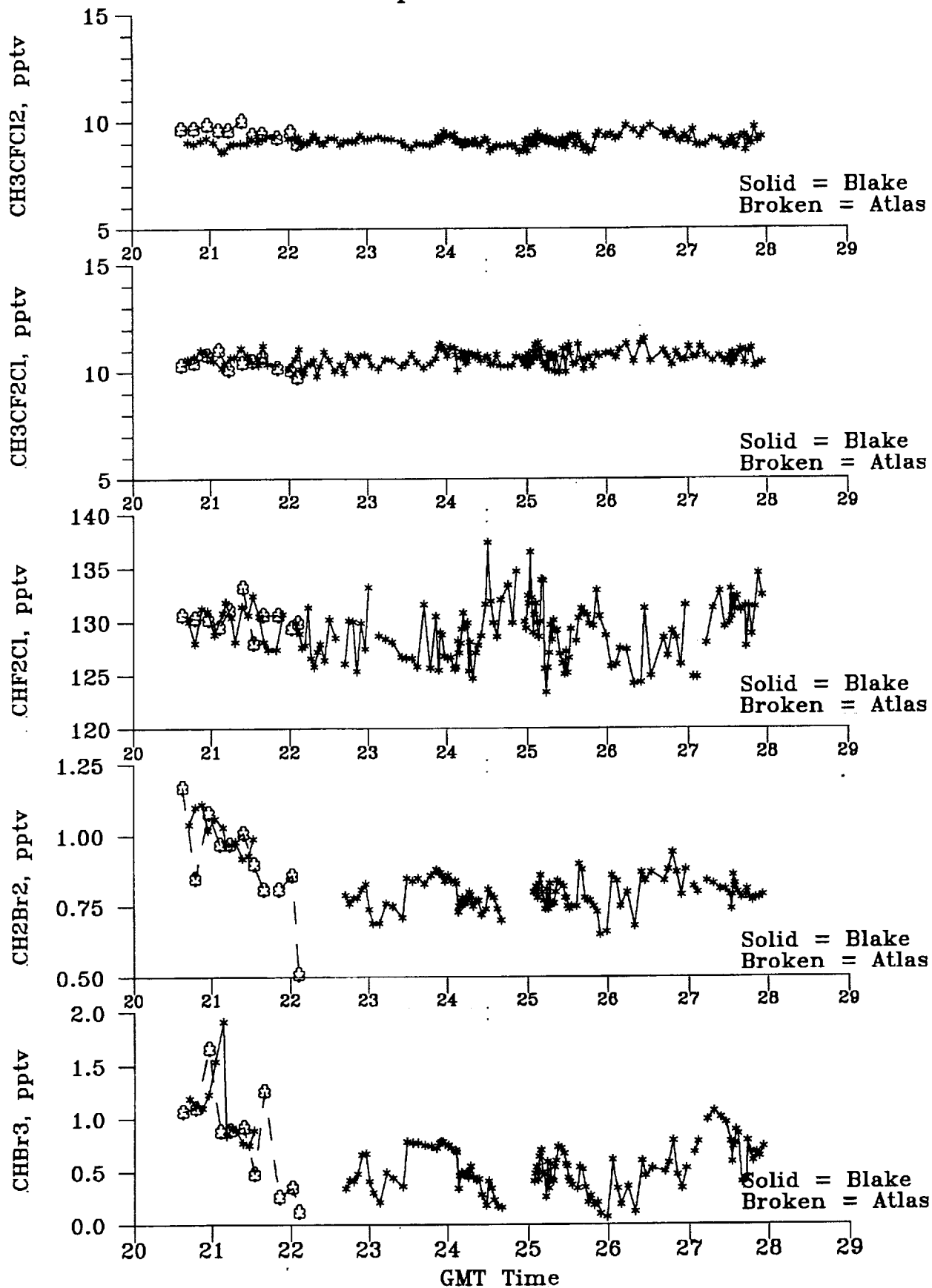
PEM Tropics B; DC-8; FLIGHT 18



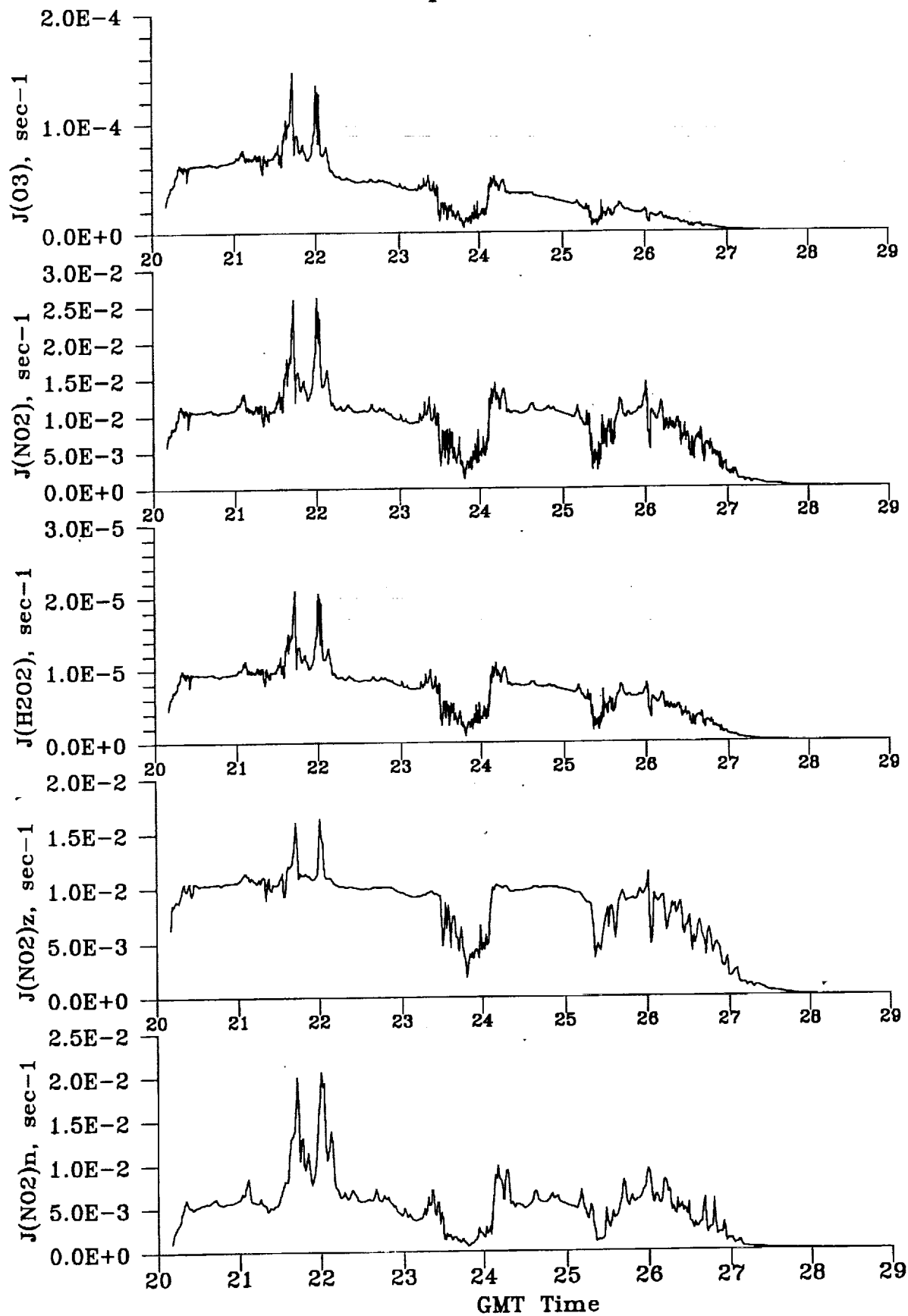
PEM Tropics B; DC-8; FLIGHT 18



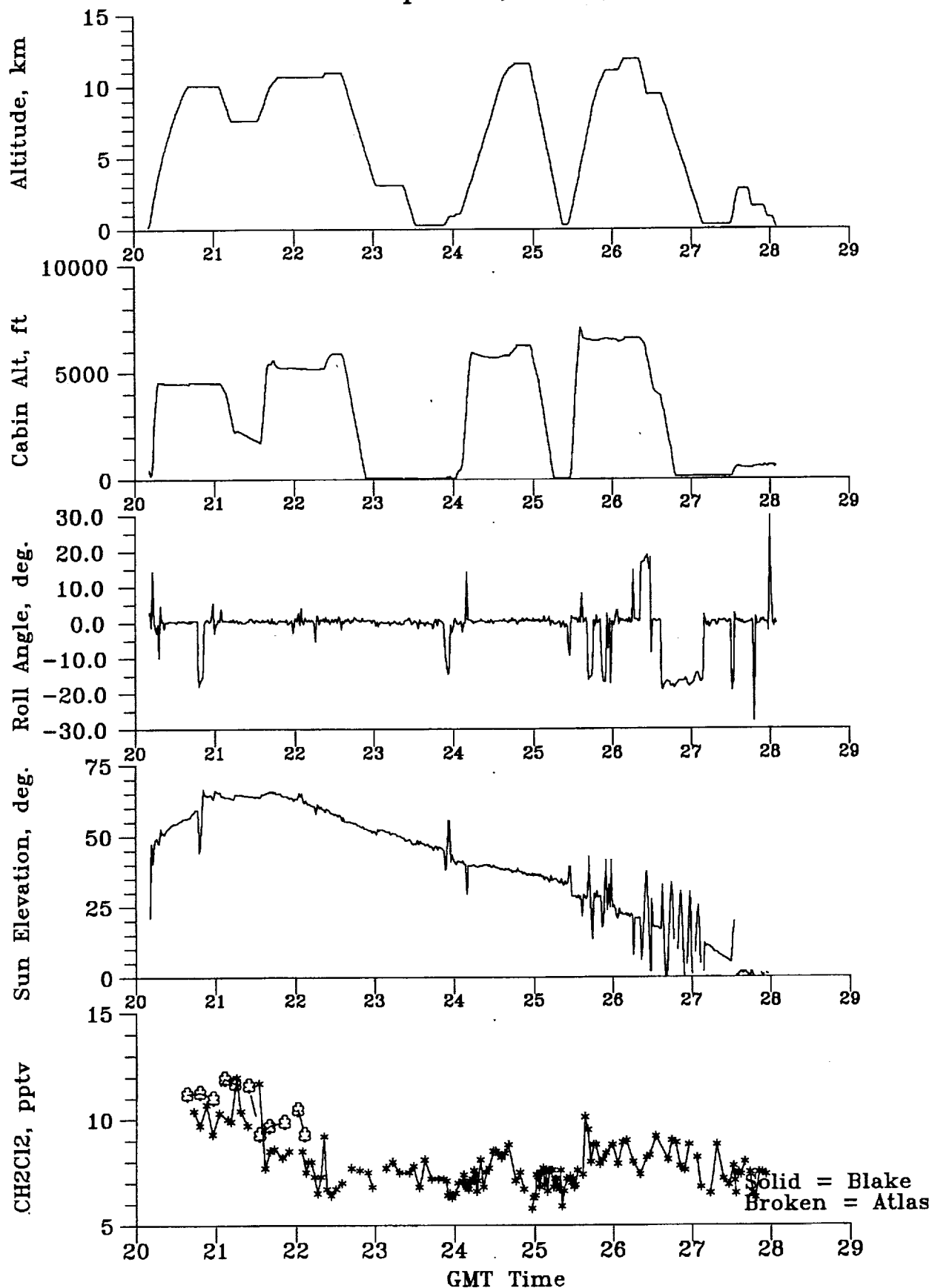
PEM Tropics B; DC-8; FLIGHT 18



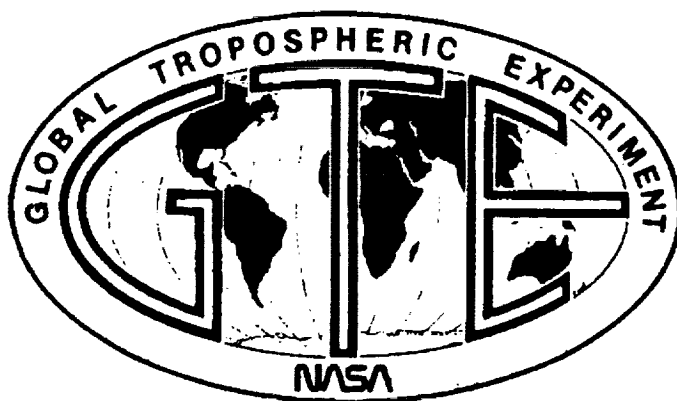
PEM Tropics B; DC-8; FLIGHT 18



PEM Tropics B; DC-8; FLIGHT 18



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

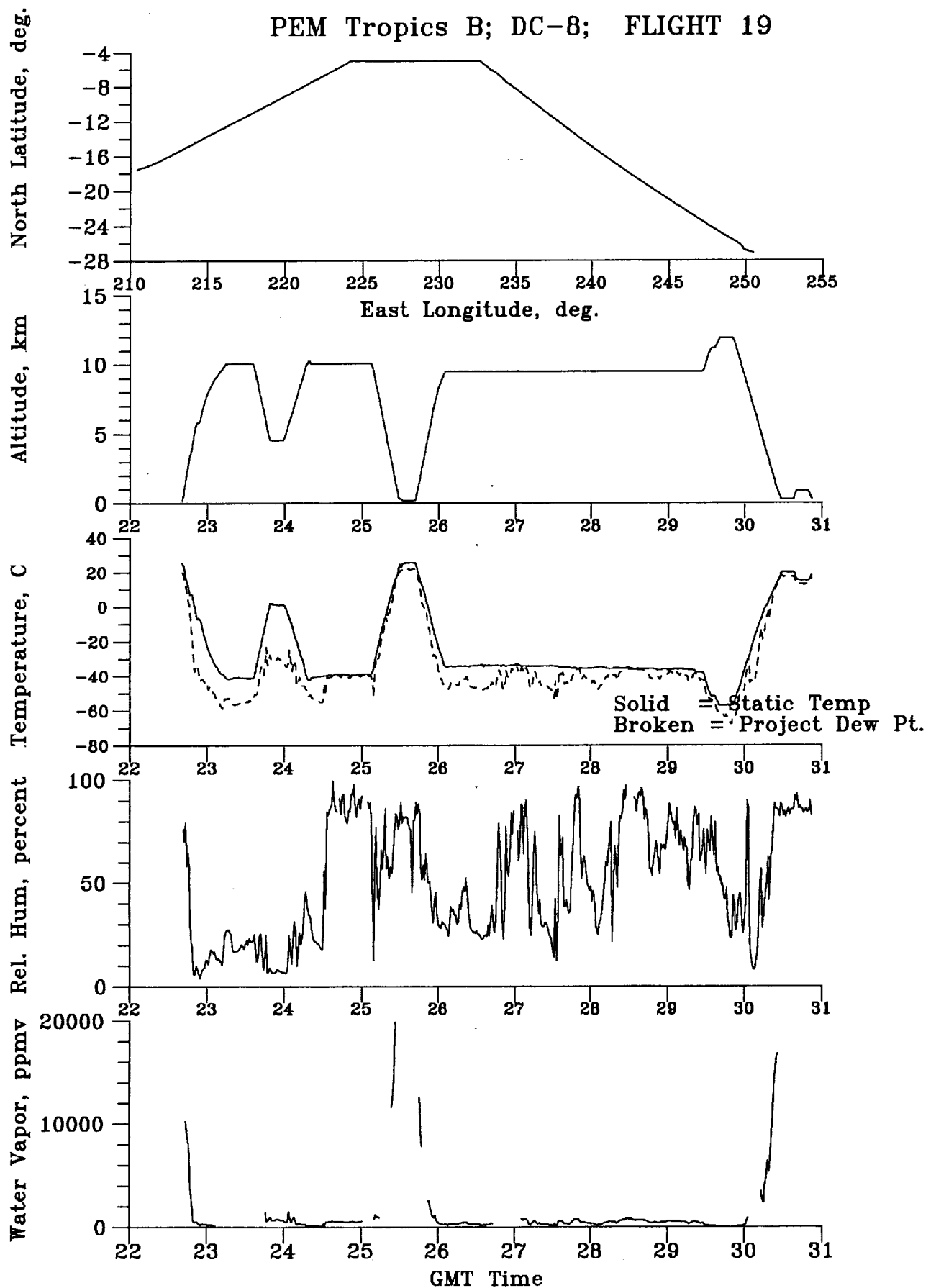
Flight 19D

Transit: Tahiti to Easter Island

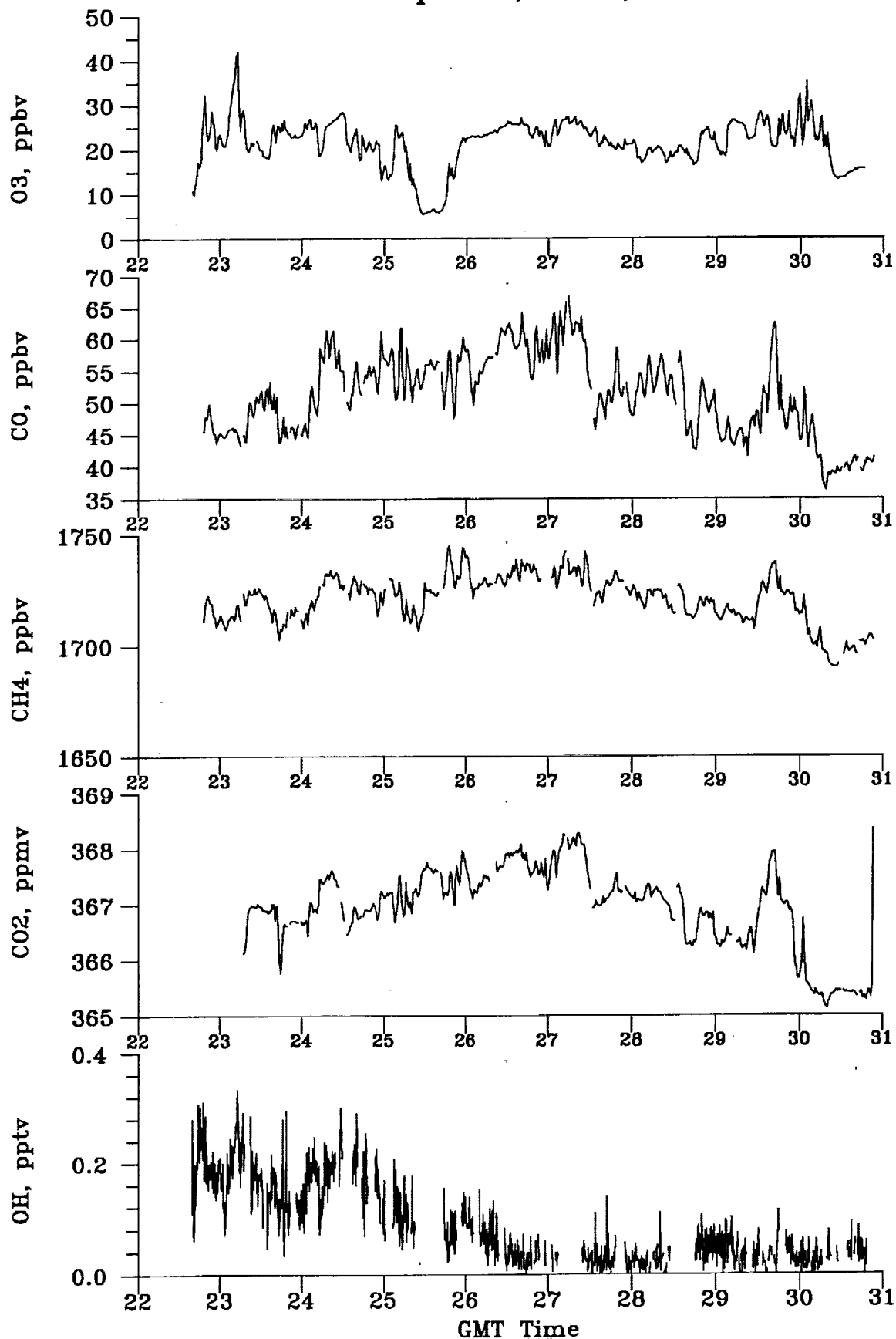
Tropical Convective Outflow

April 13, 1999

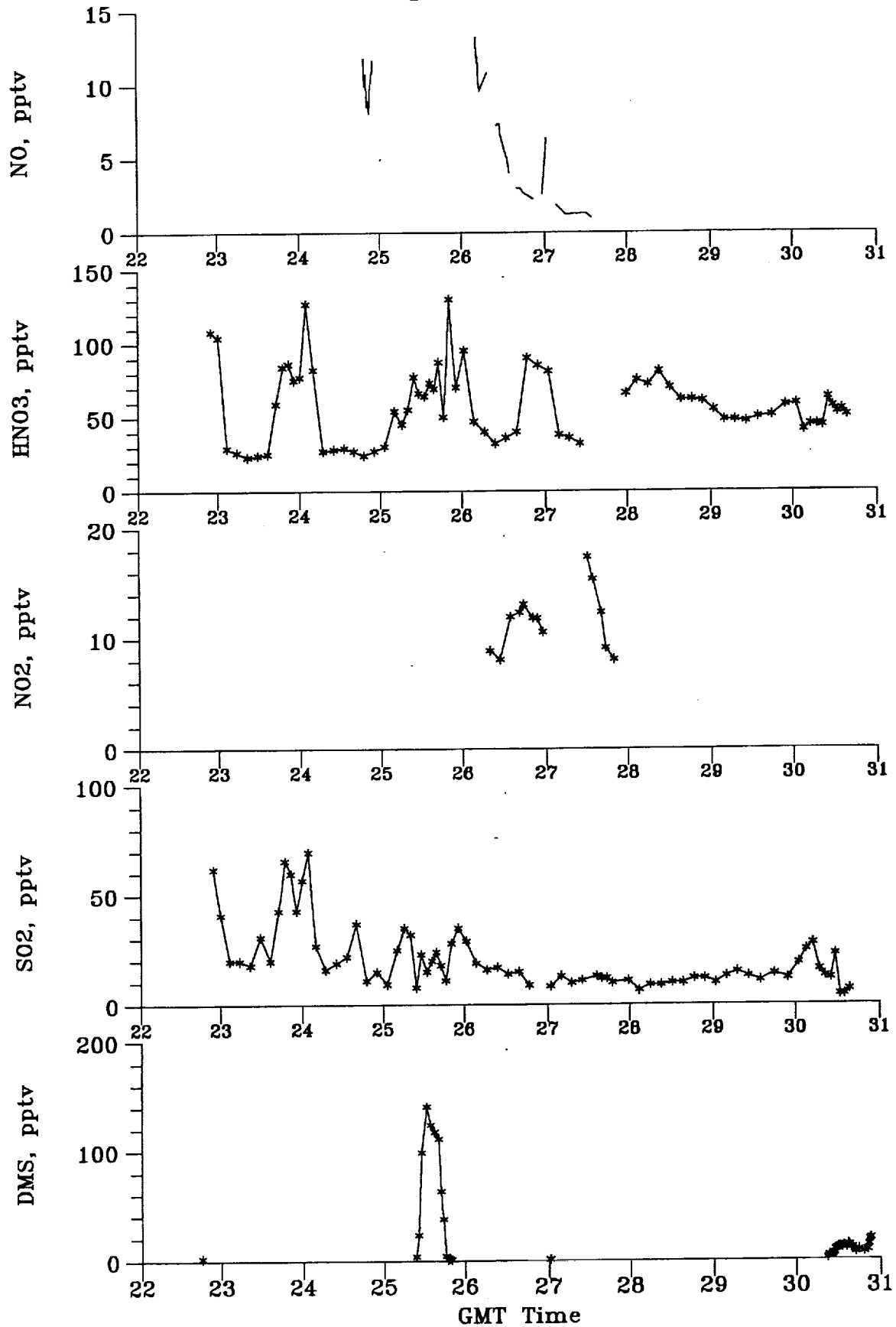
PEM Tropics B; DC-8; FLIGHT 19



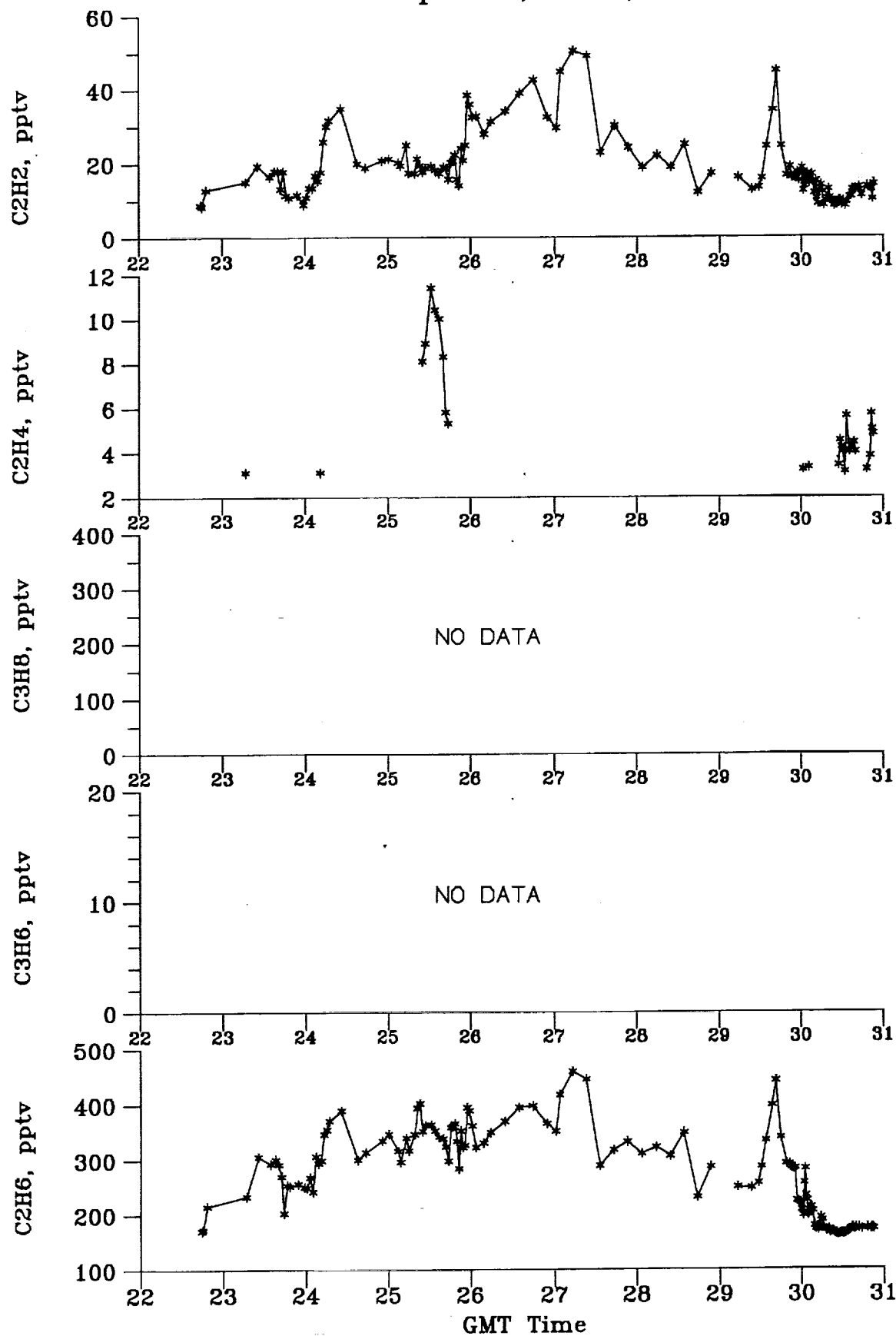
PEM Tropics B; DC-8; FLIGHT 19



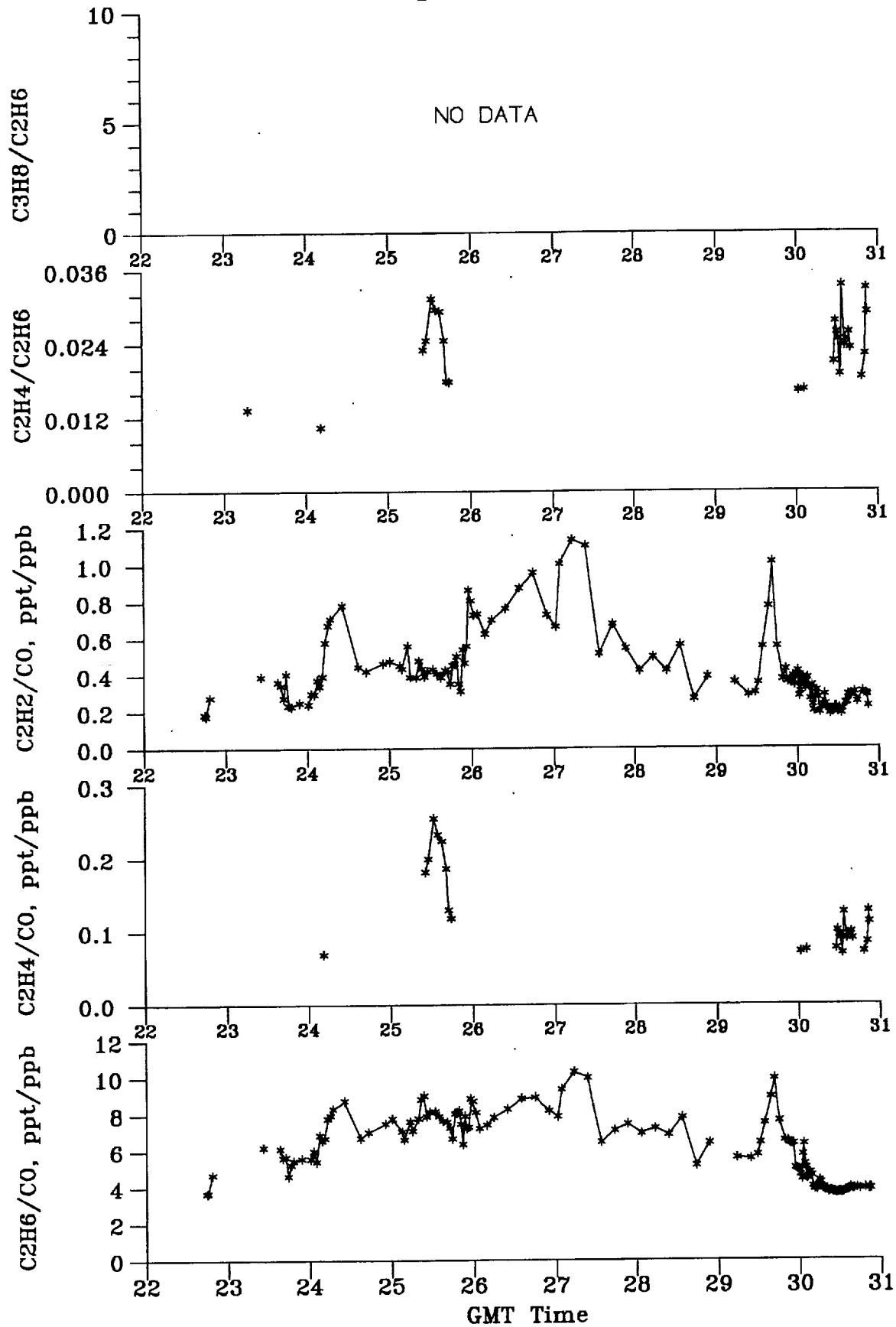
PEM Tropics B; DC-8; FLIGHT 19



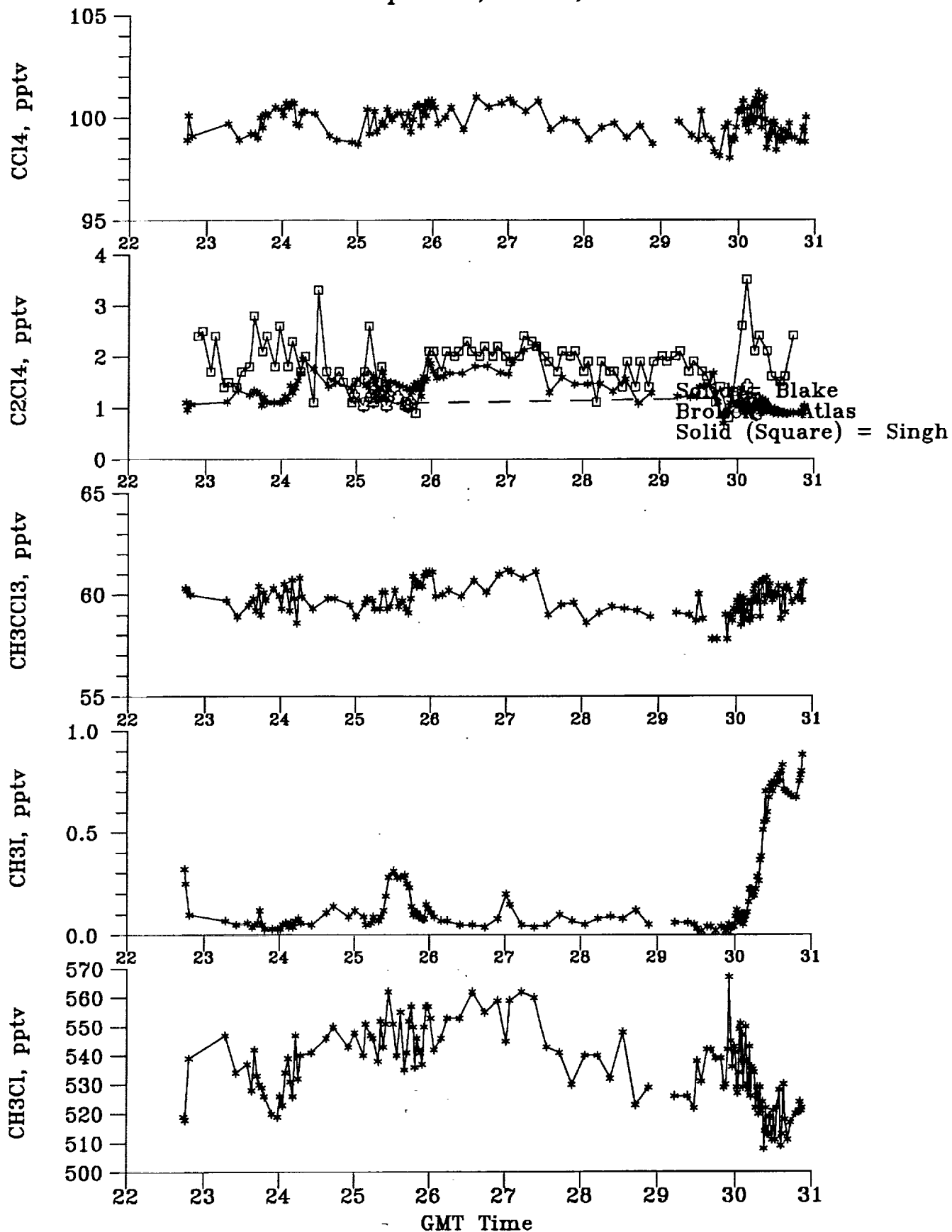
PEM Tropics B; DC-8; FLIGHT 19



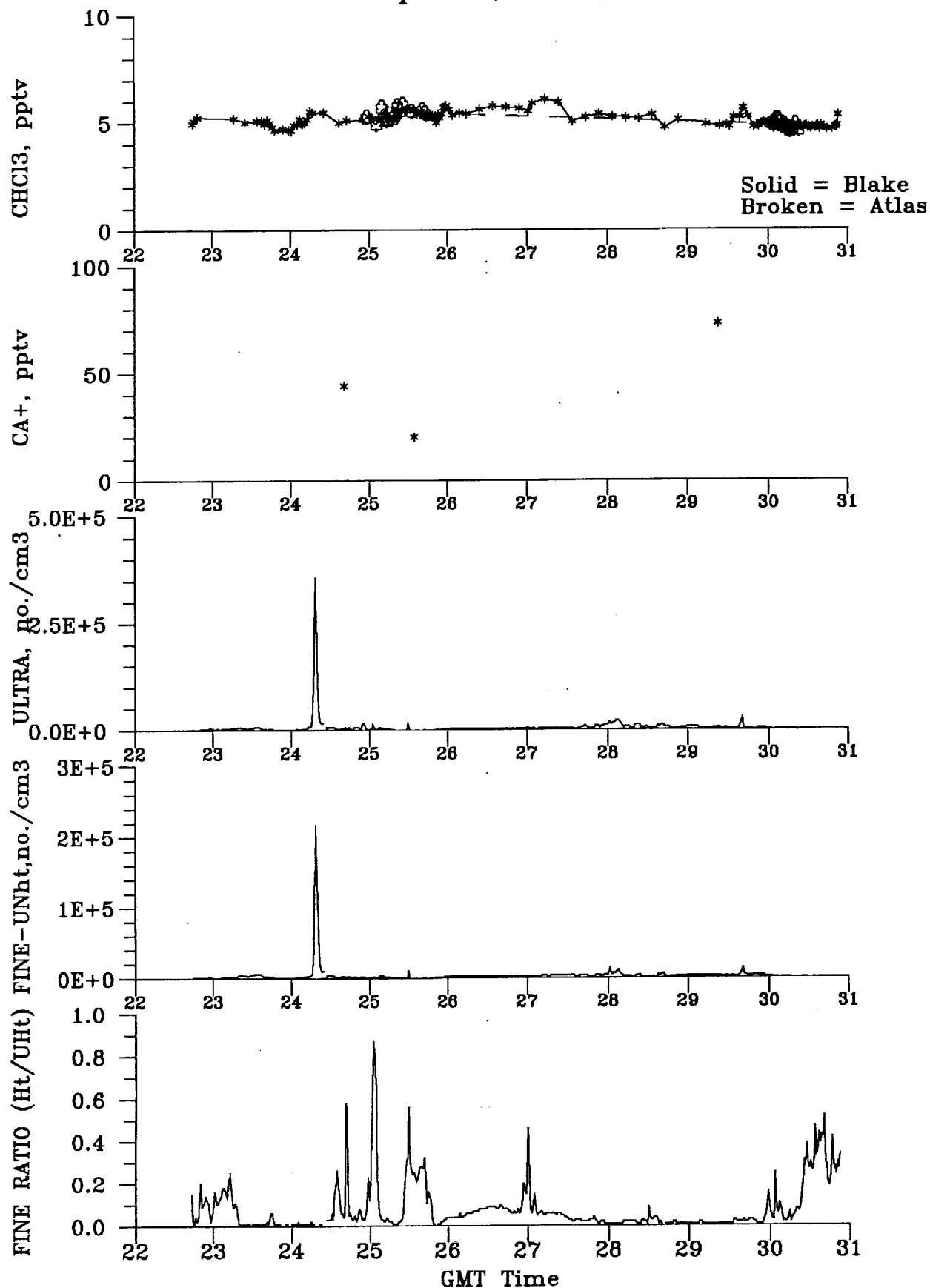
PEM Tropics B; DC-8; FLIGHT 19



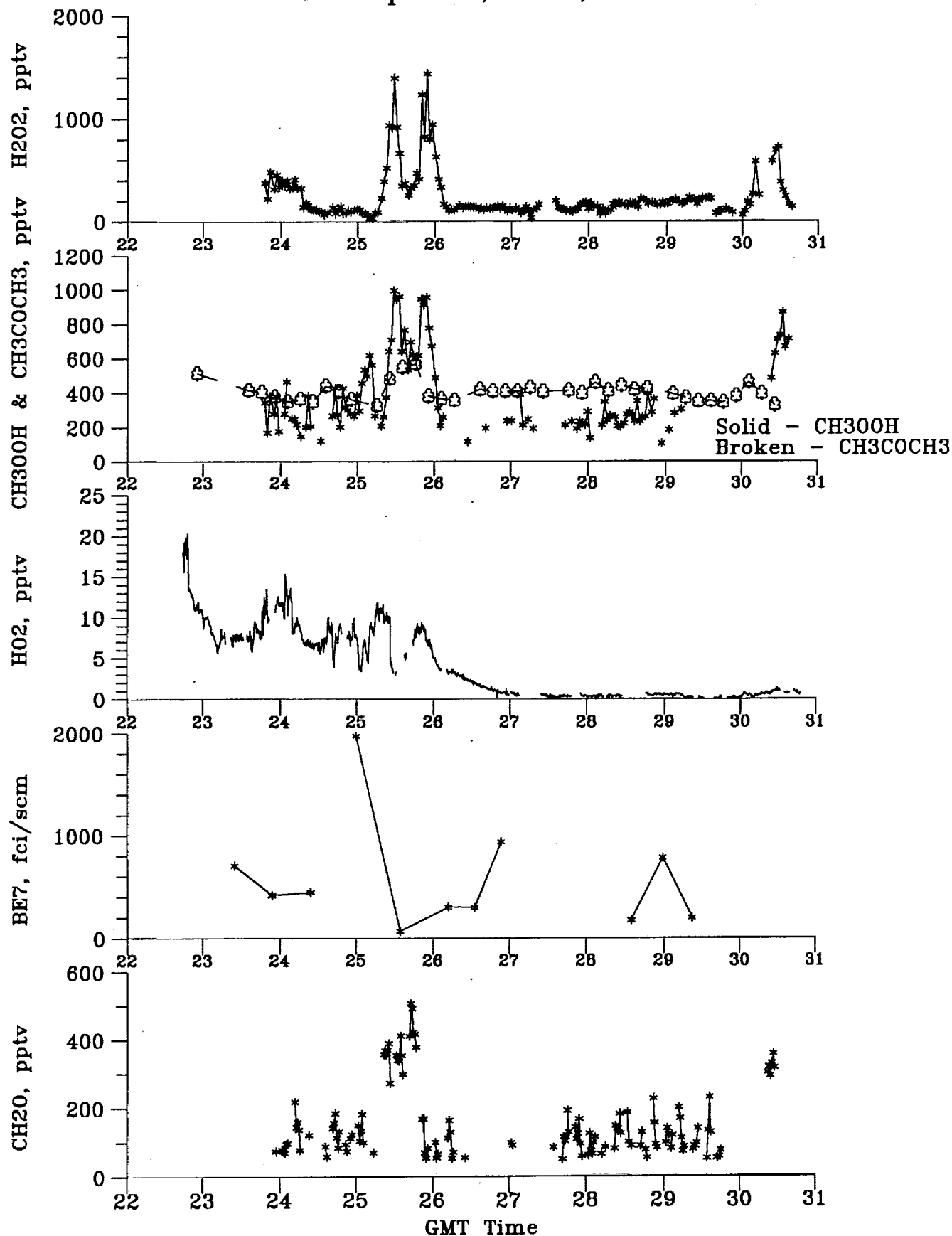
PEM Tropics B; DC-8; FLIGHT 19



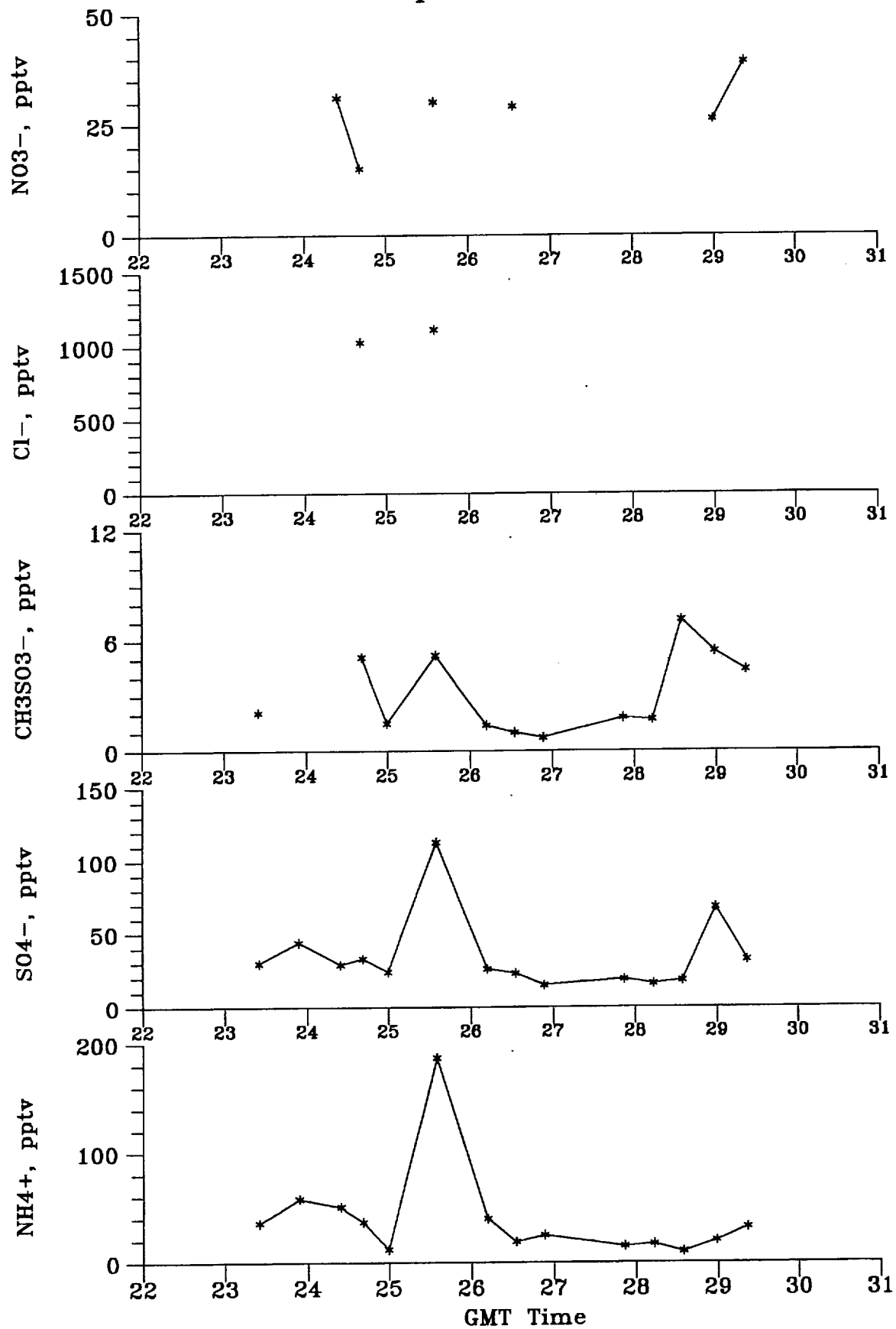
PEM Tropics B; DC-8; FLIGHT 19



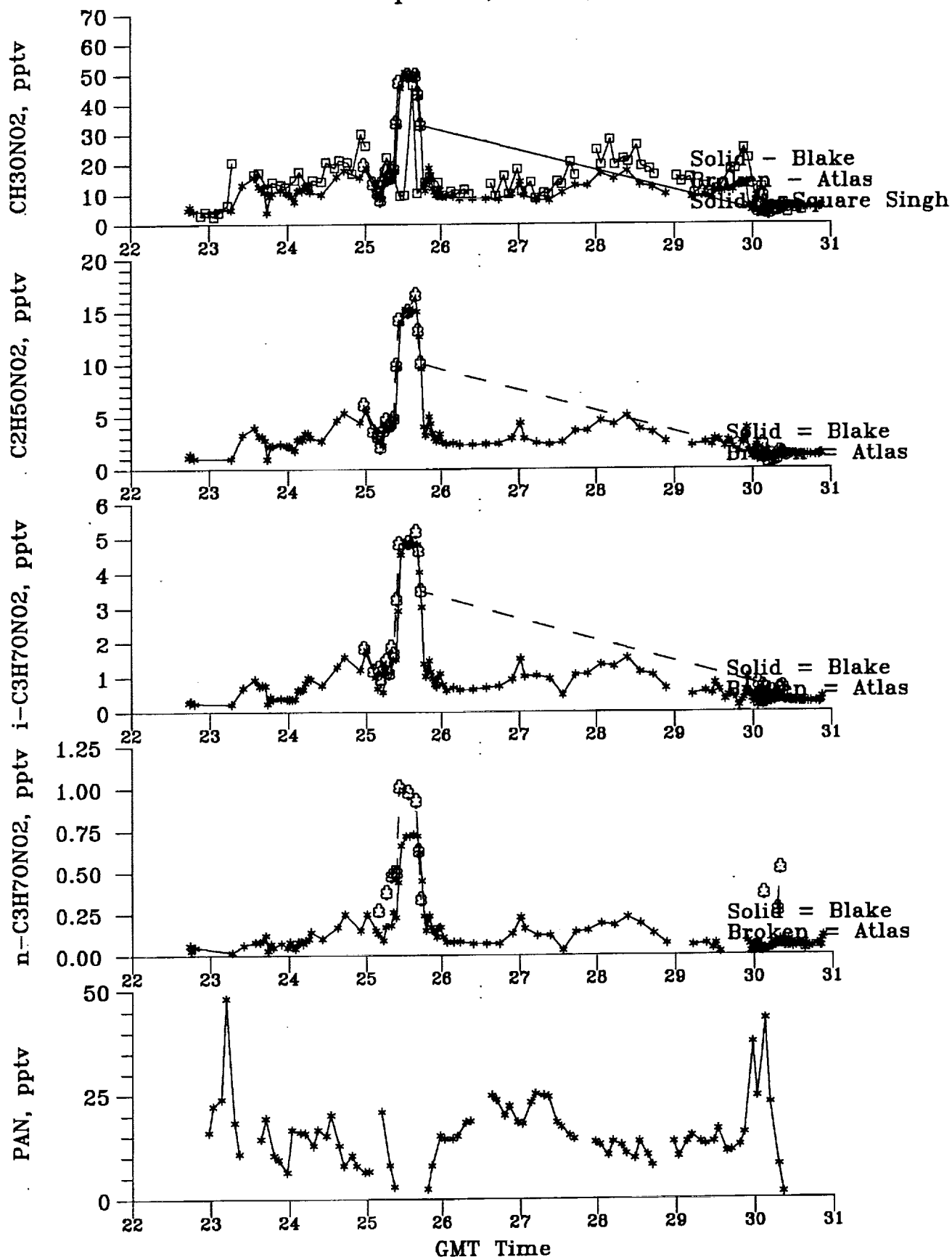
PEM Tropics B; DC-8; FLIGHT 19



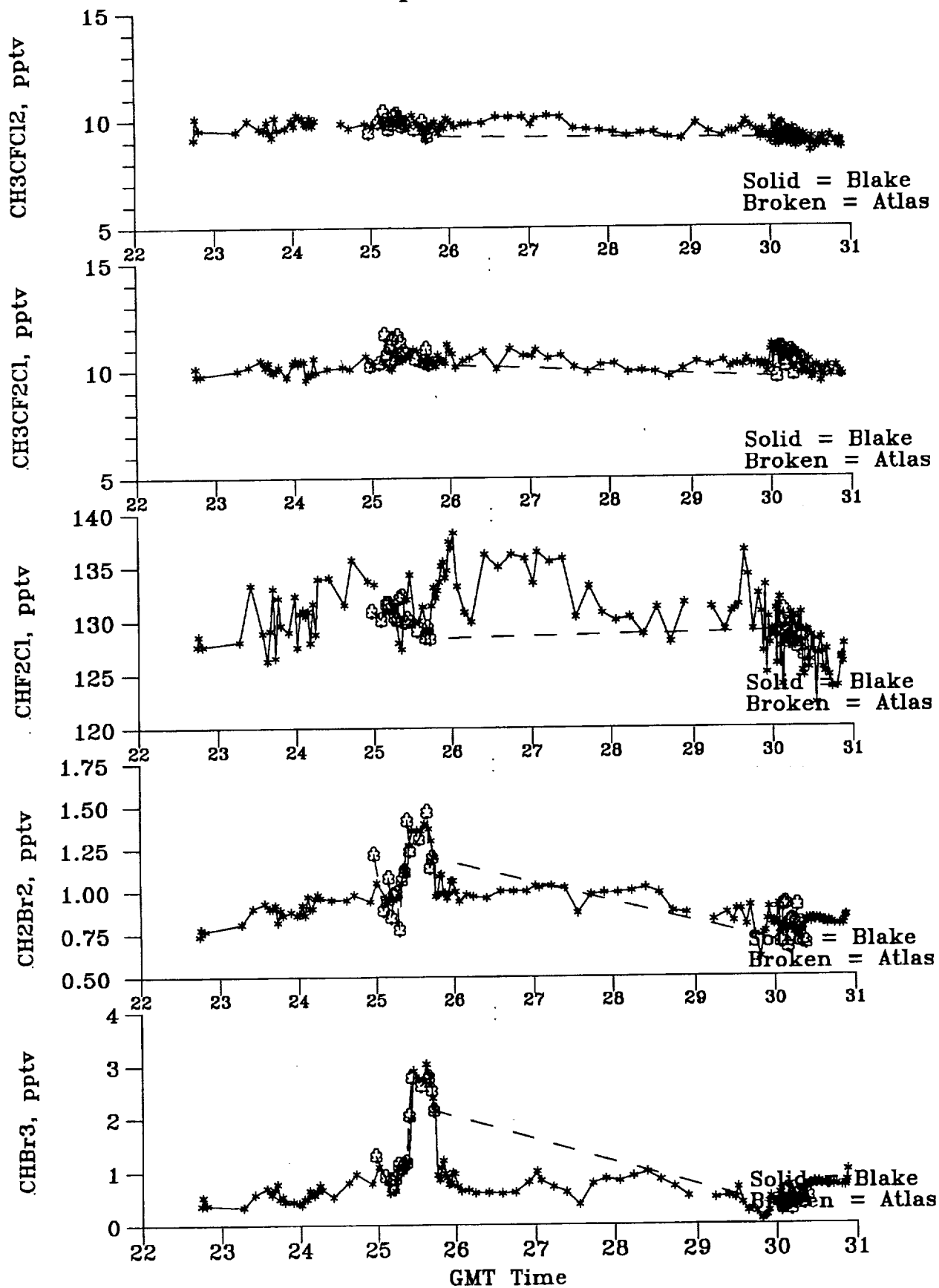
PEM Tropics B; DC-8; FLIGHT 19



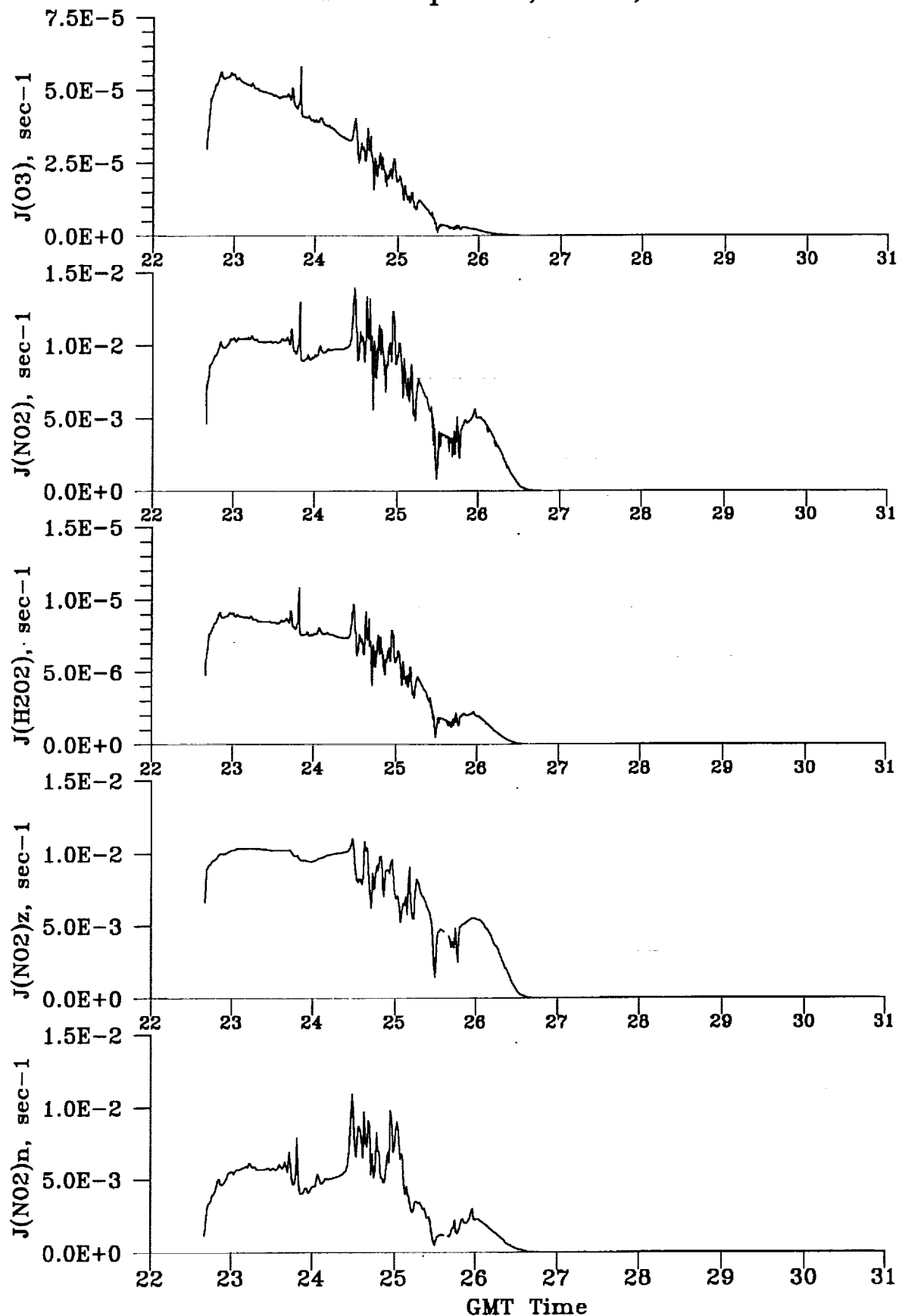
PEM Tropics B; DC-8; FLIGHT 19



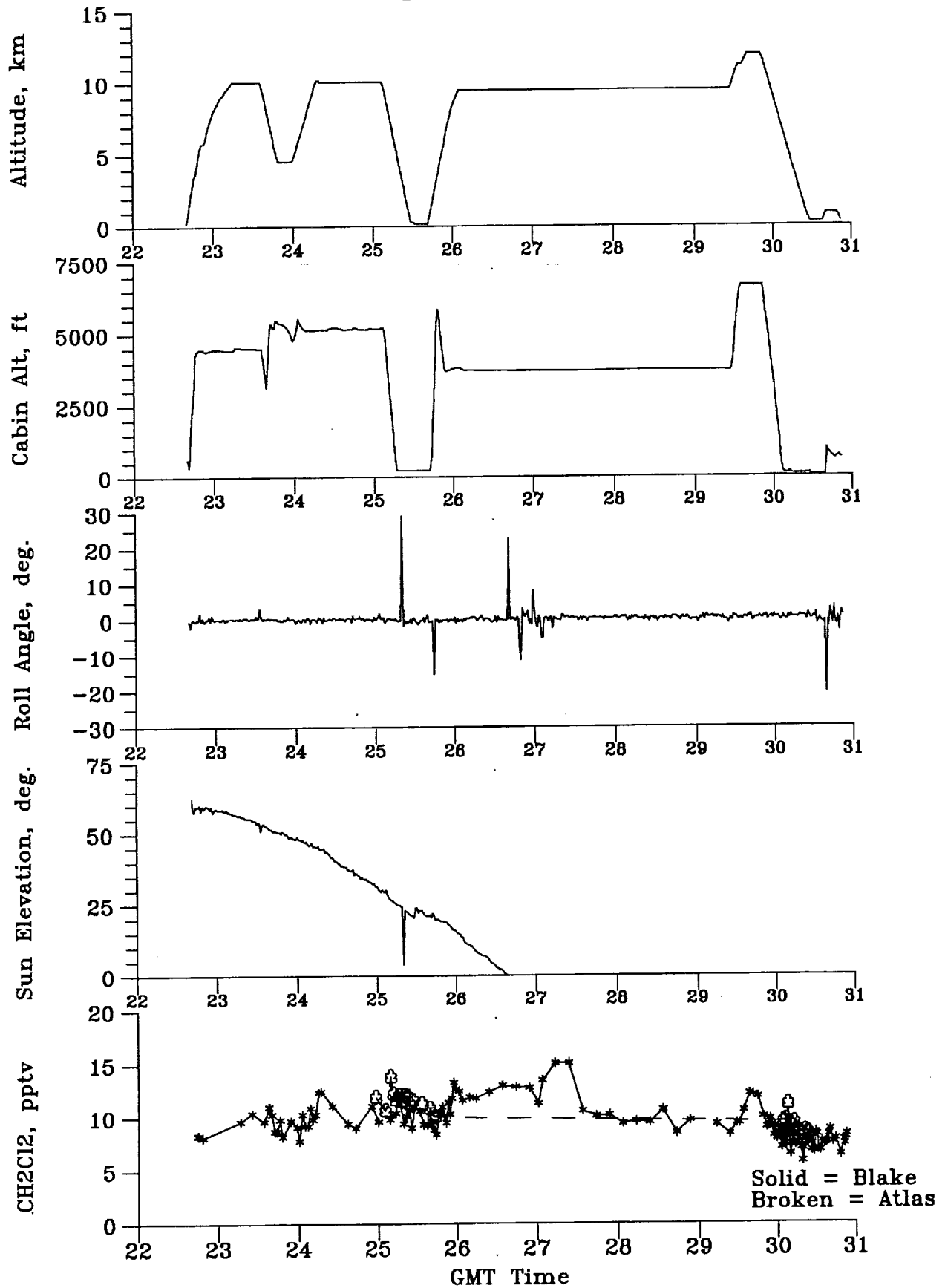
PEM Tropics B; DC-8; FLIGHT 19



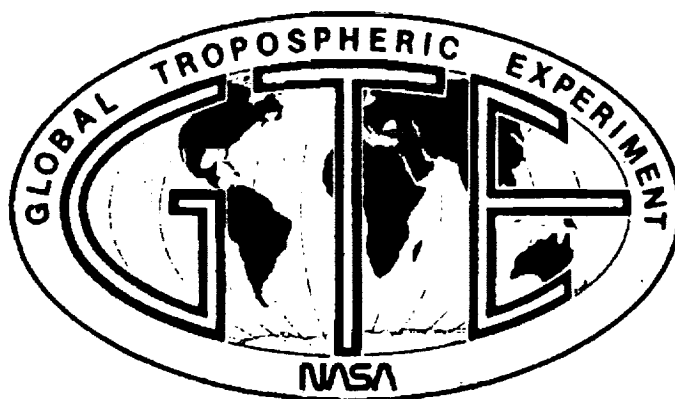
PEM Tropics B; DC-8; FLIGHT 19



PEM Tropics B; DC-8; FLIGHT 19



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

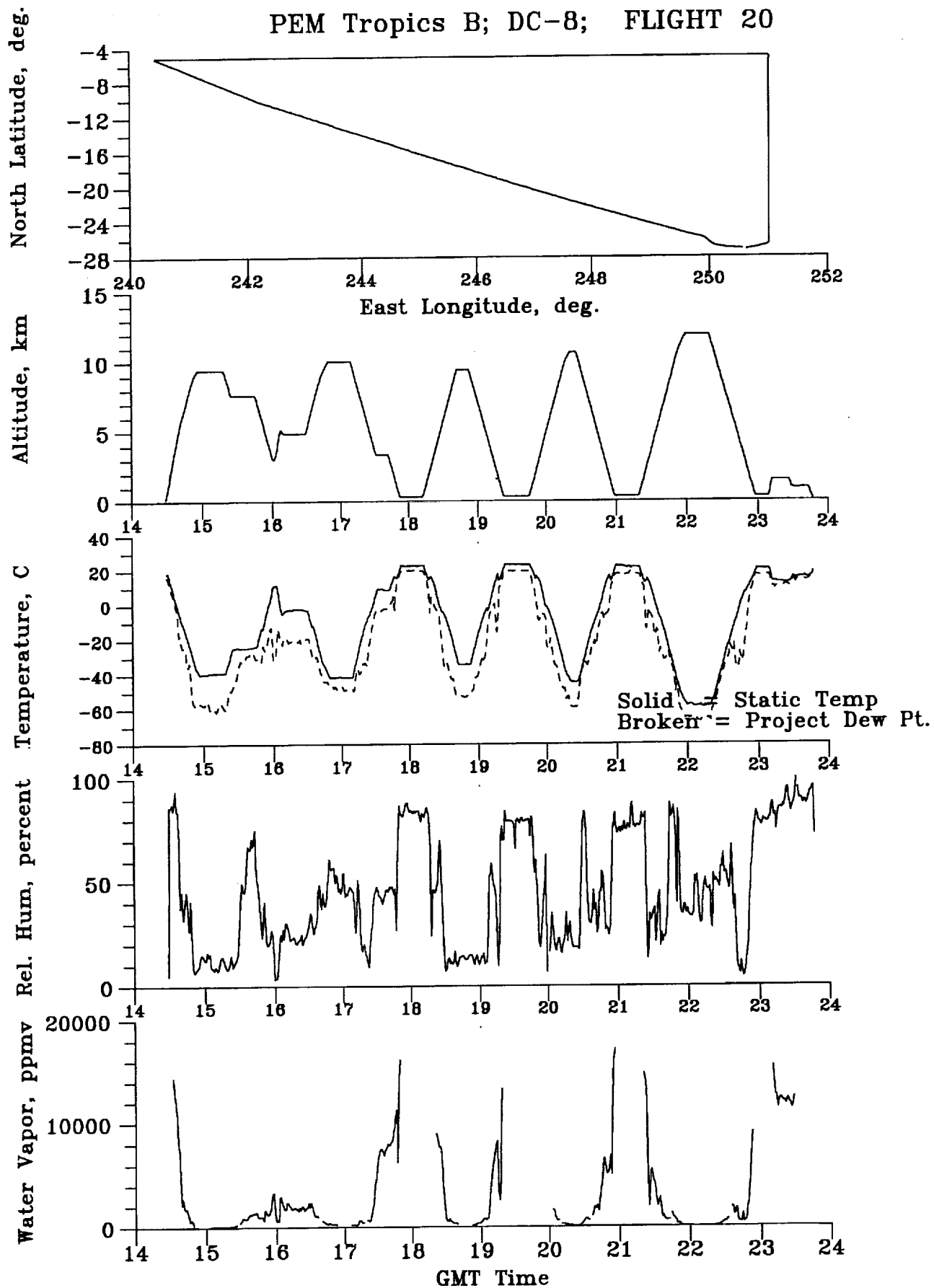
Flight 20D

Local: Easter Island No. 1

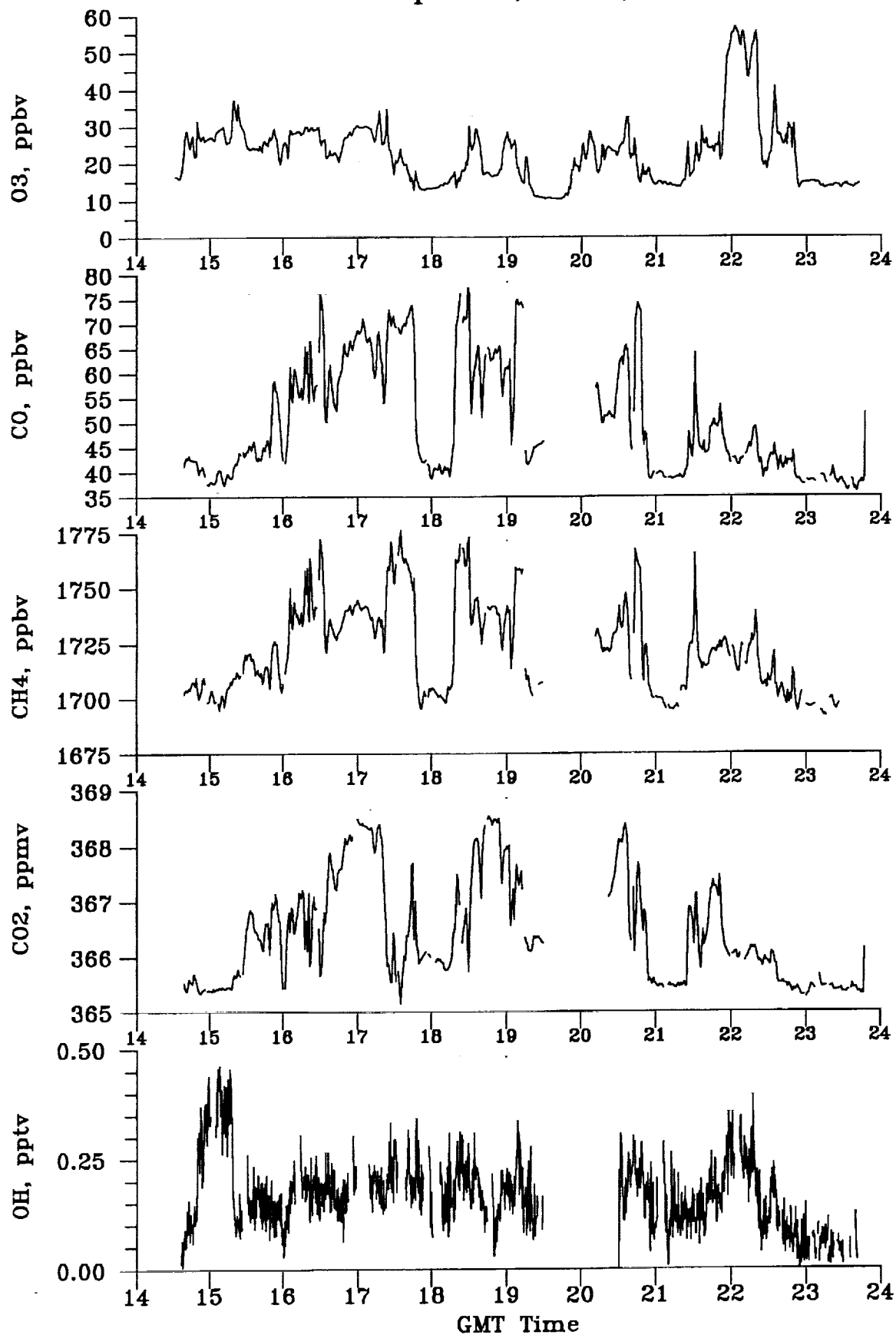
South American Outflow

April 15, 1999

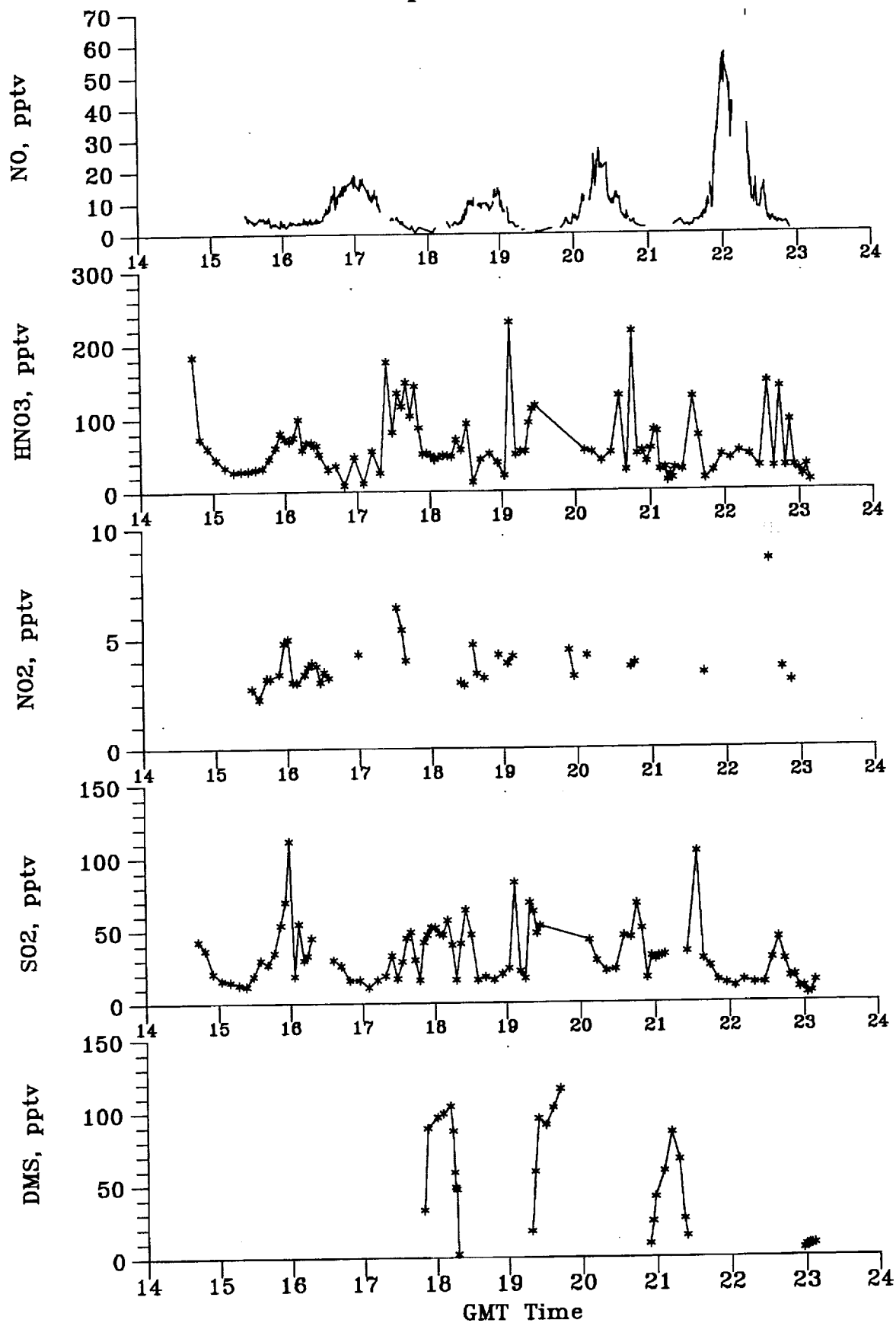
PEM Tropics B; DC-8; FLIGHT 20



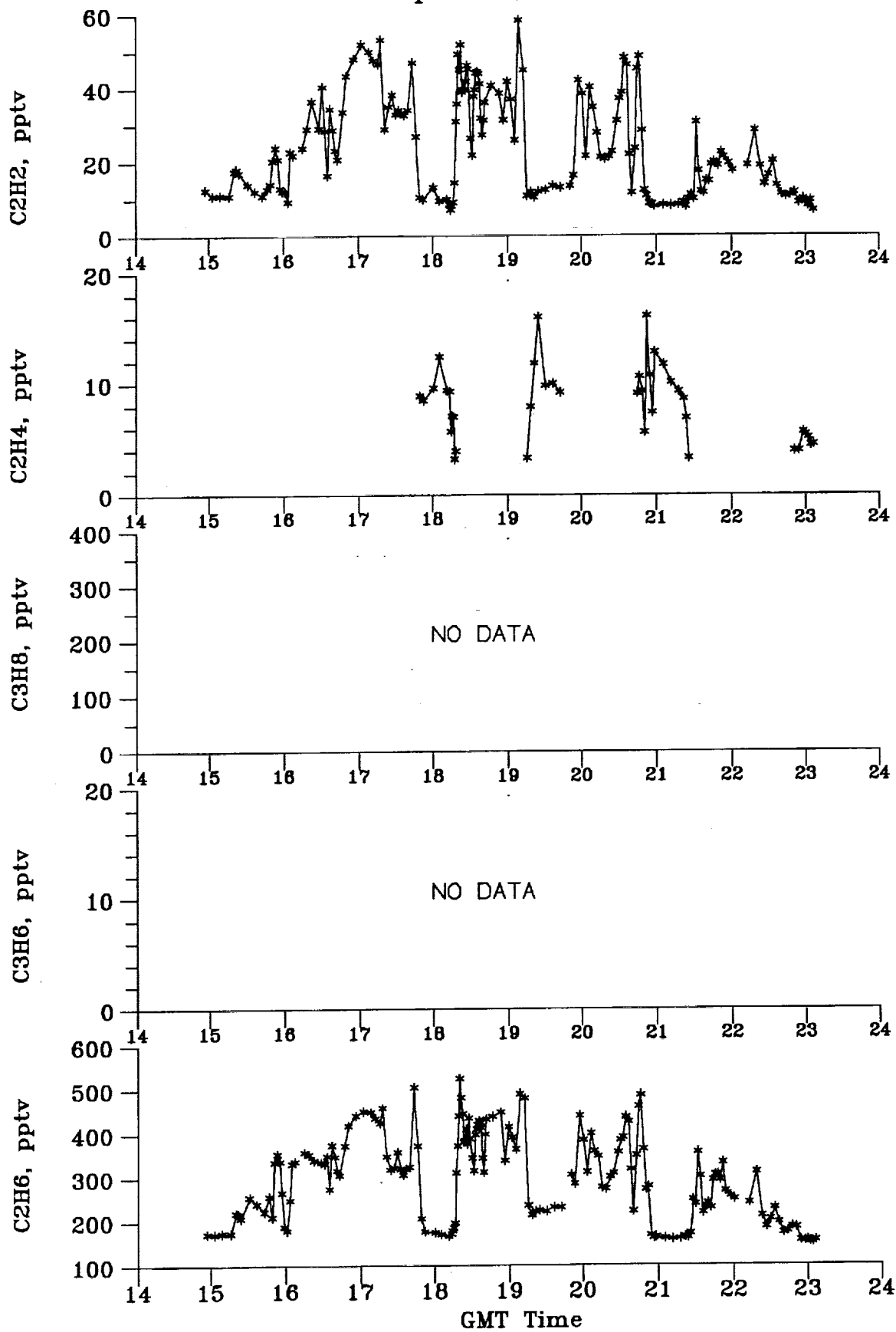
PEM Tropics B; DC-8; FLIGHT 20



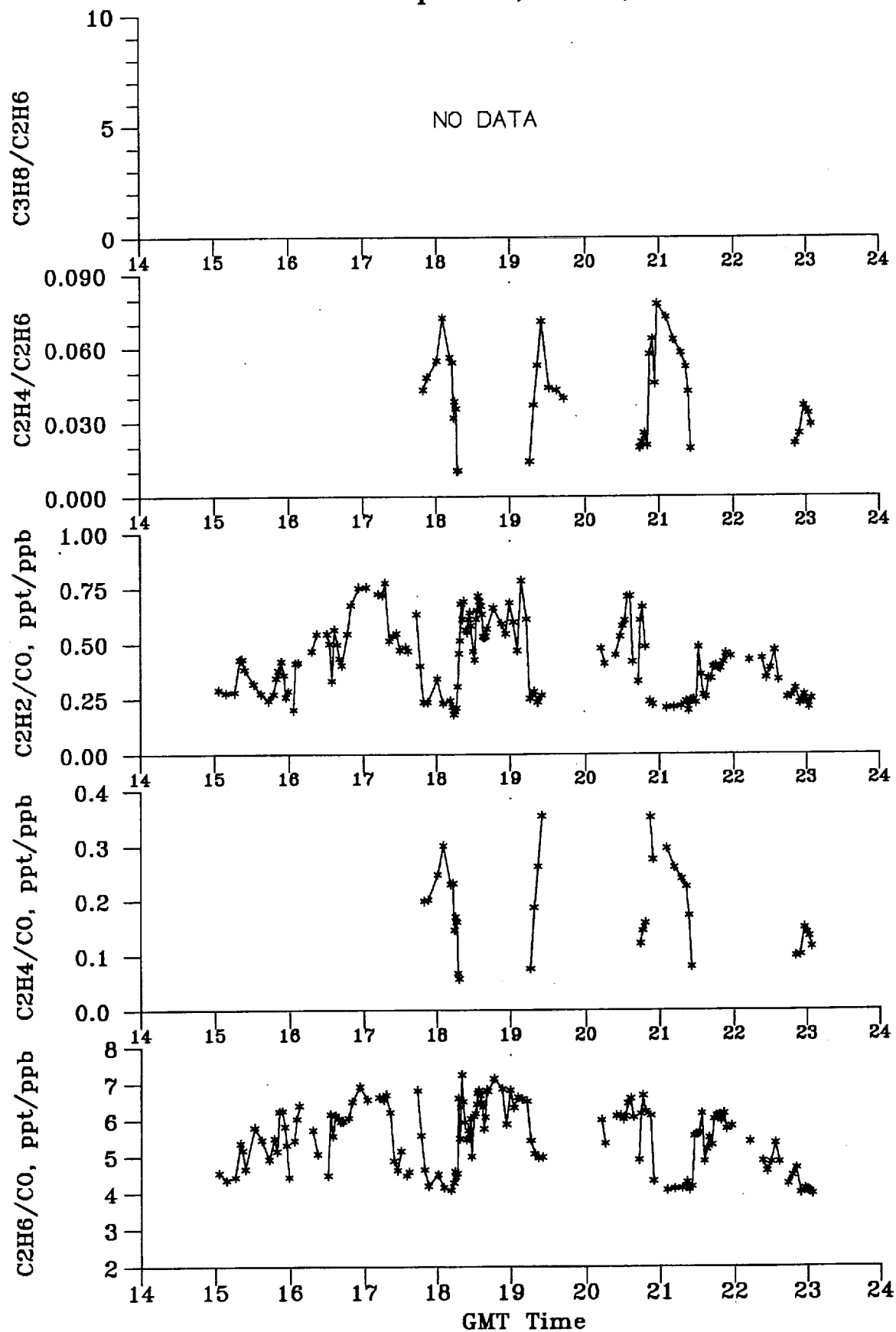
PEM Tropics B; DC-8; FLIGHT 20



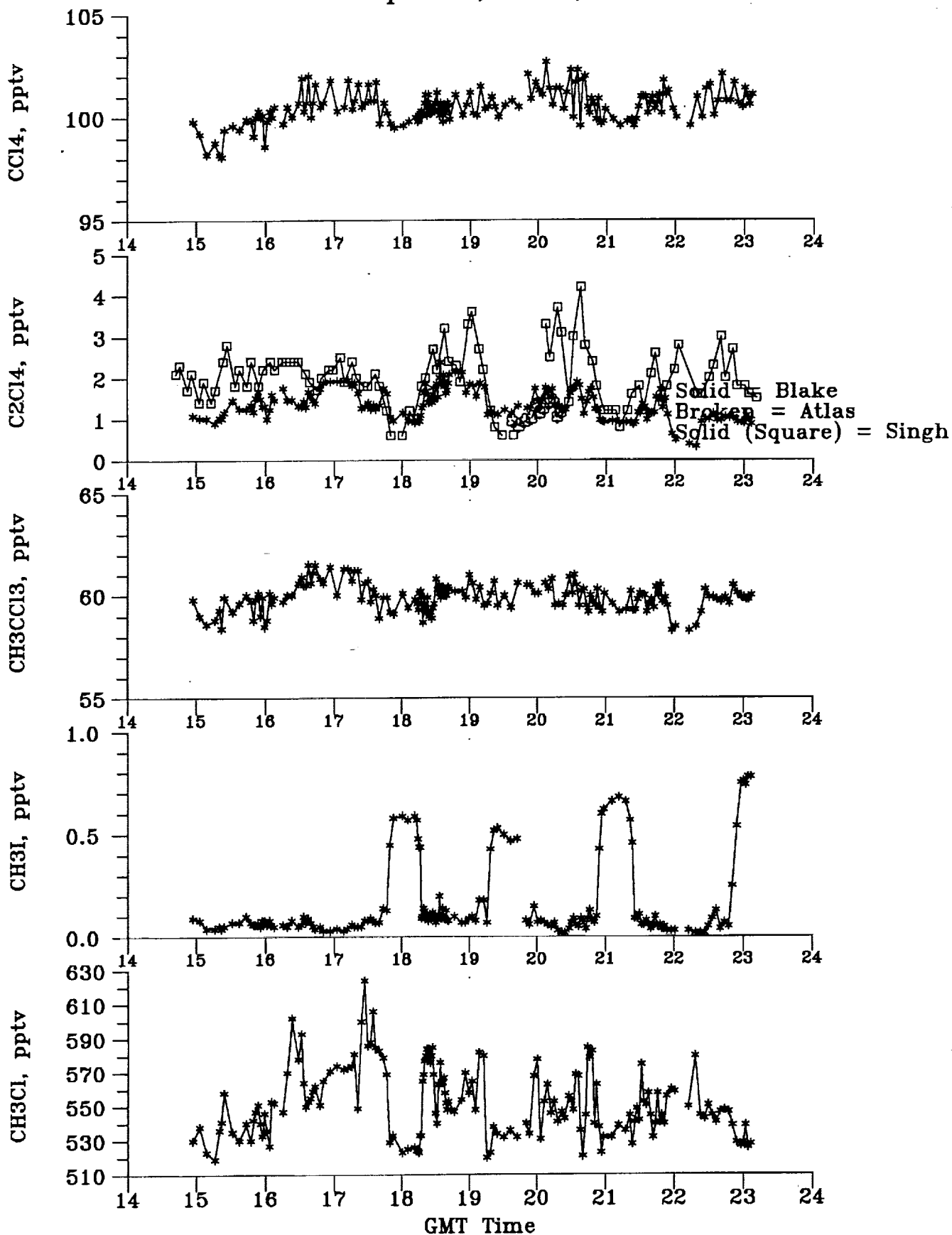
PEM Tropics B; DC-8; FLIGHT 20



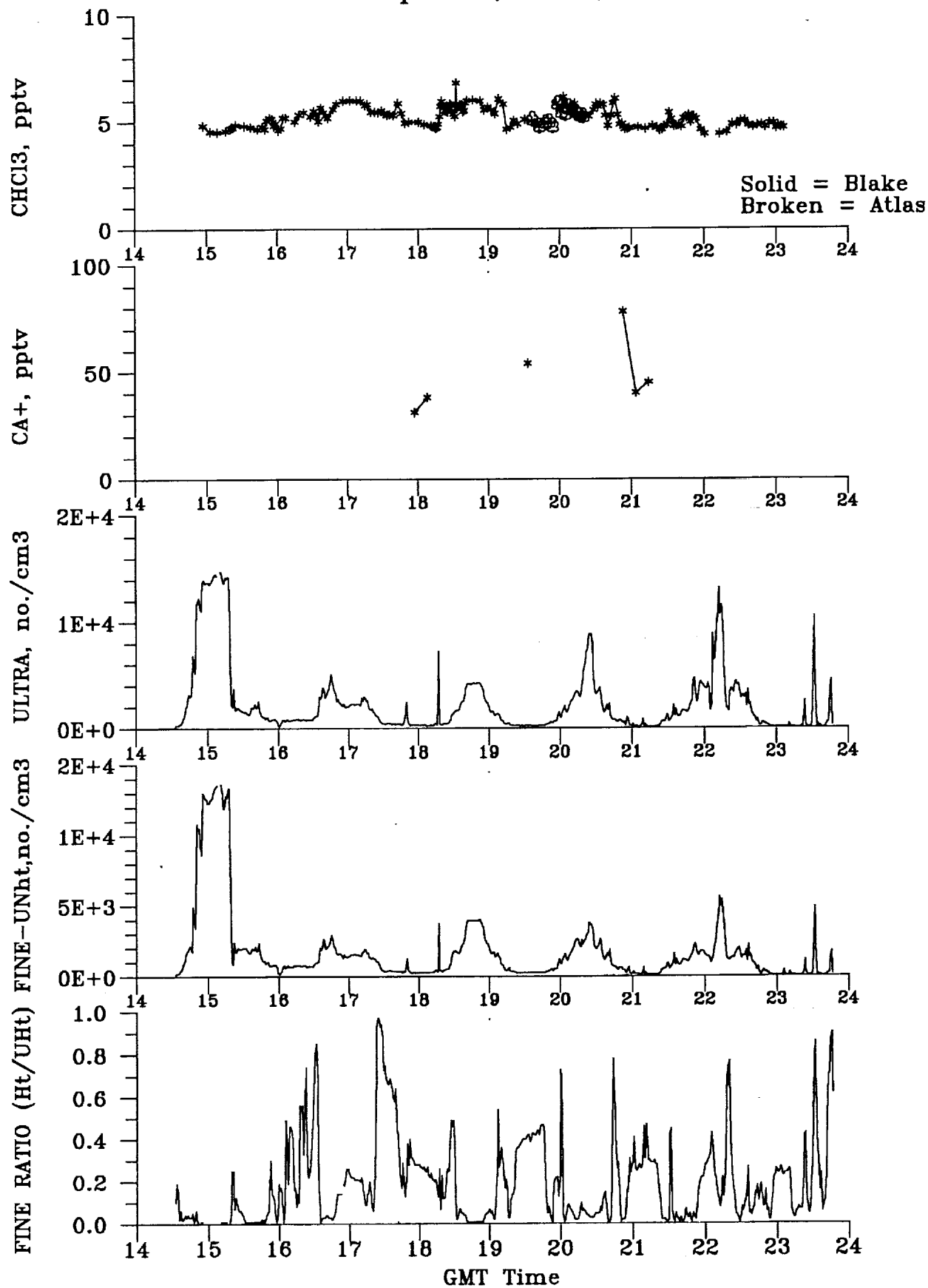
PEM Tropics B; DC-8; FLIGHT 20



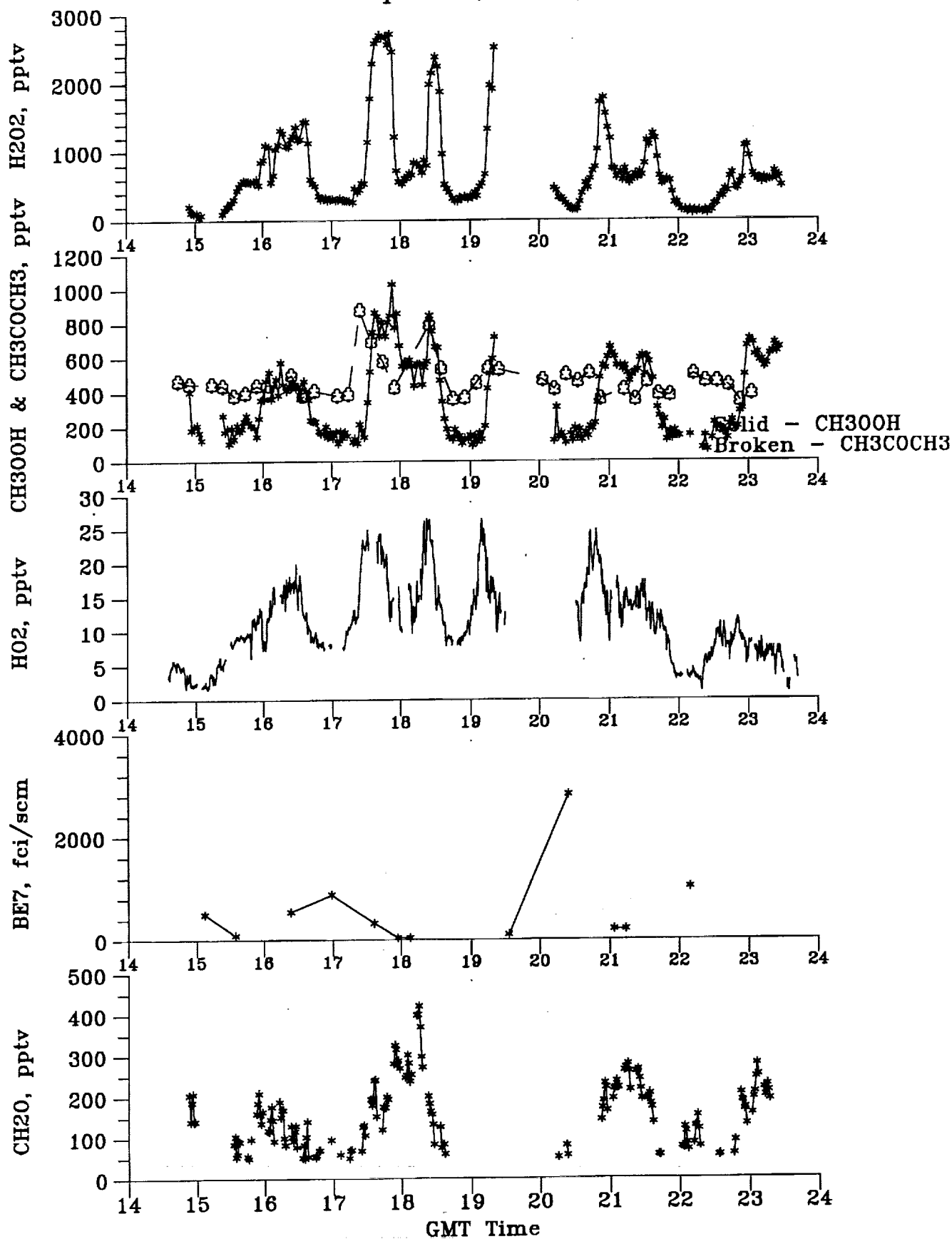
PEM Tropics B; DC-8; FLIGHT 20



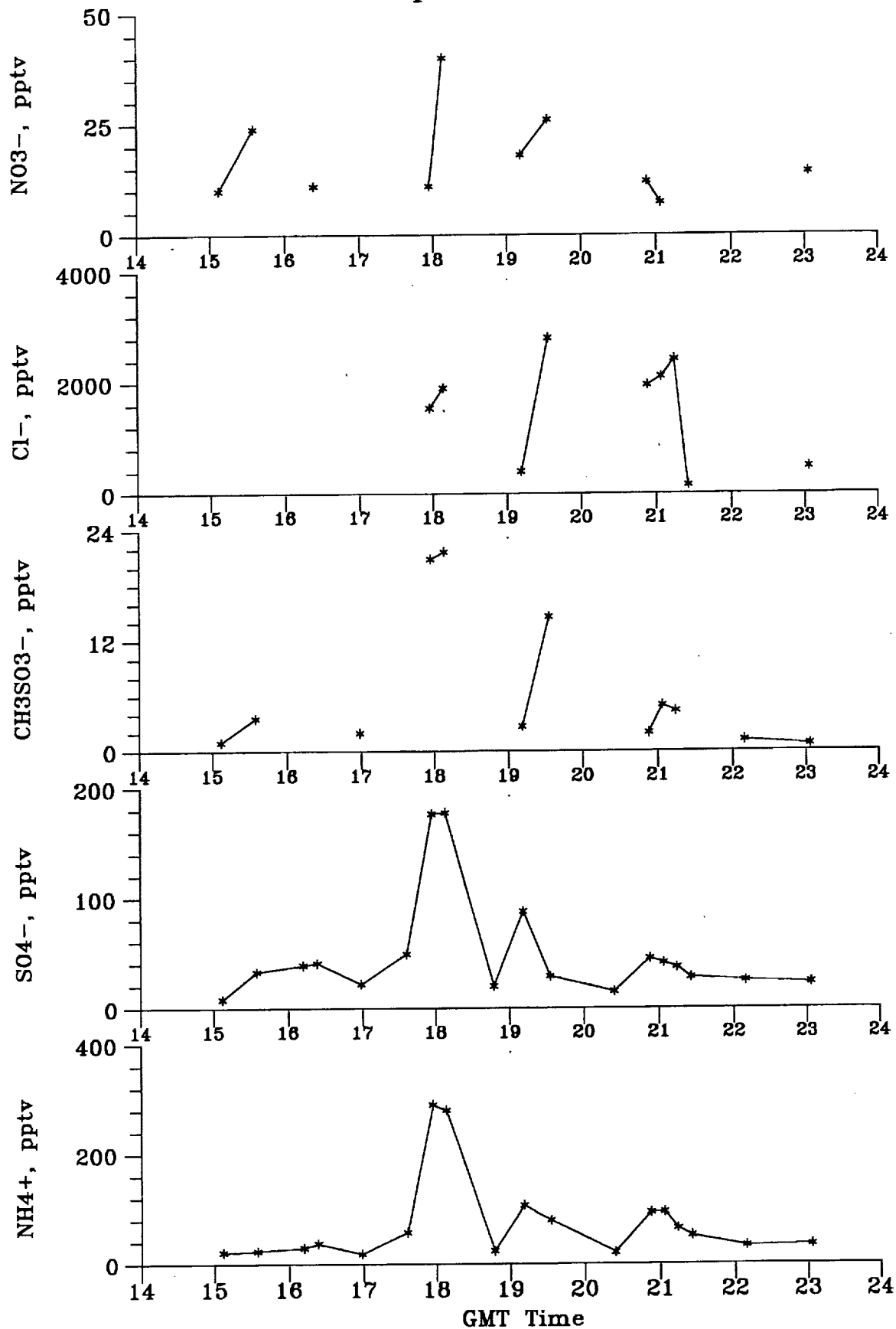
PEM Tropics B; DC-8; FLIGHT 20



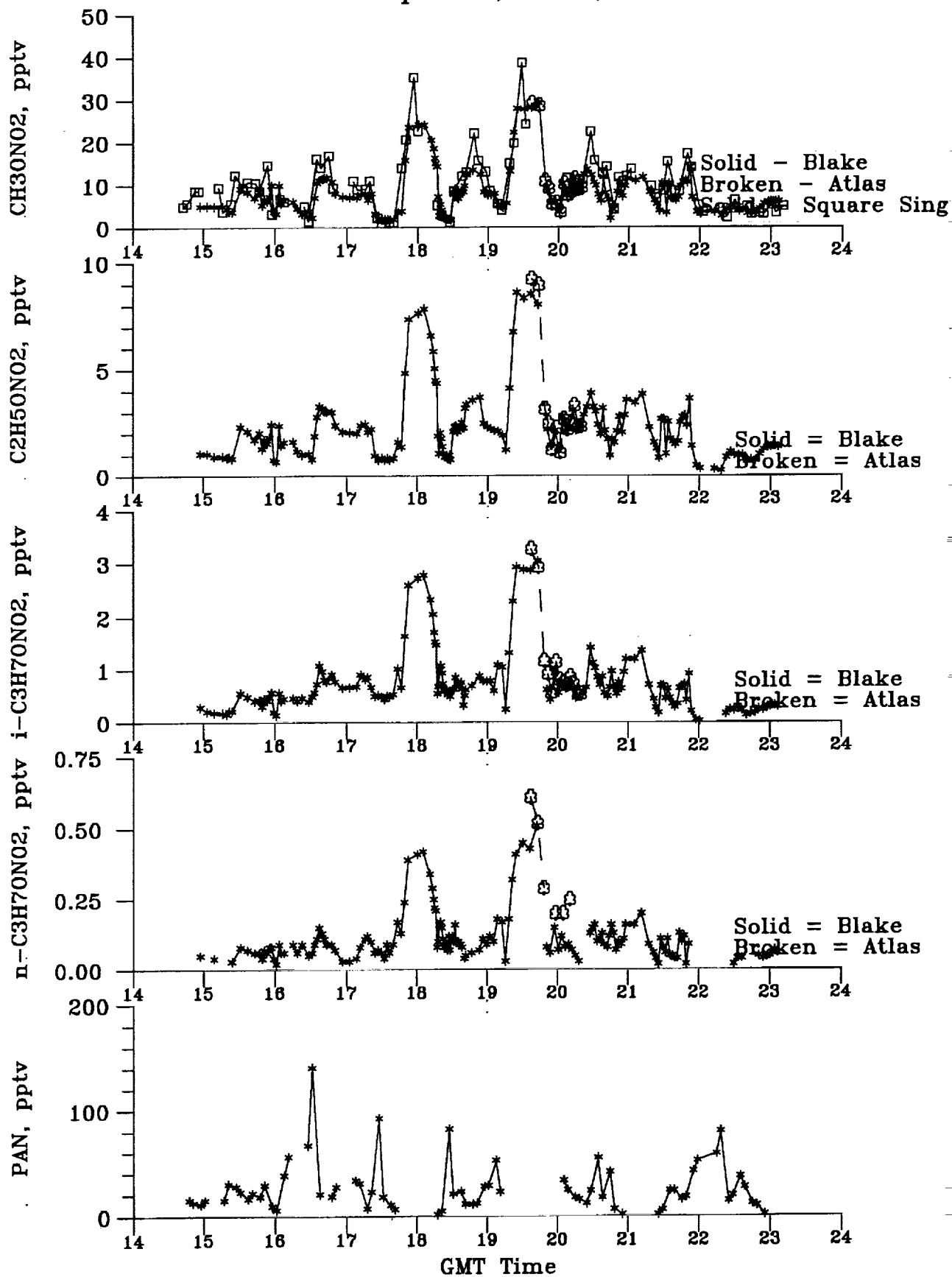
PEM Tropics B; DC-8; FLIGHT 20



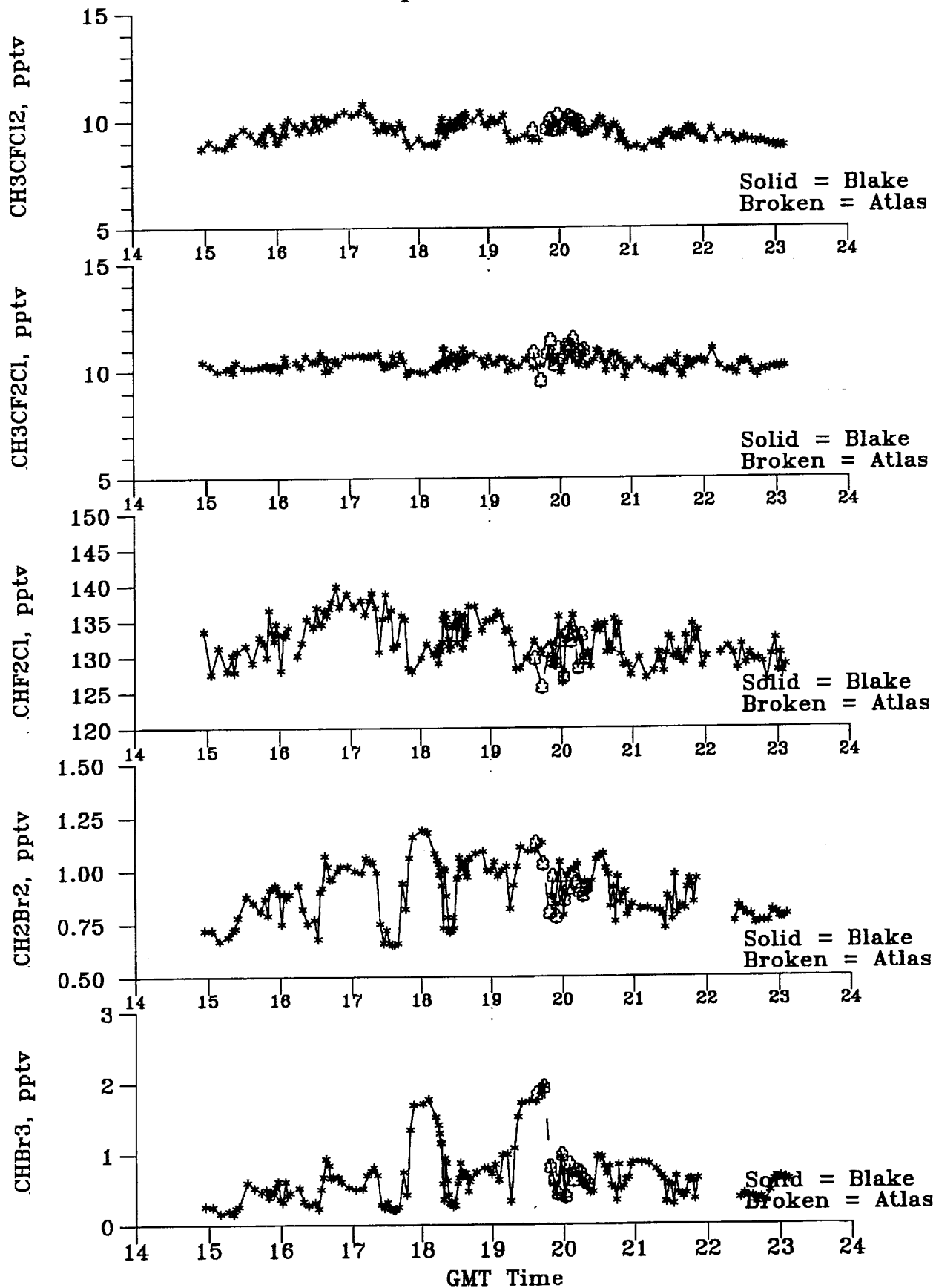
PEM Tropics B; DC-8; FLIGHT 20



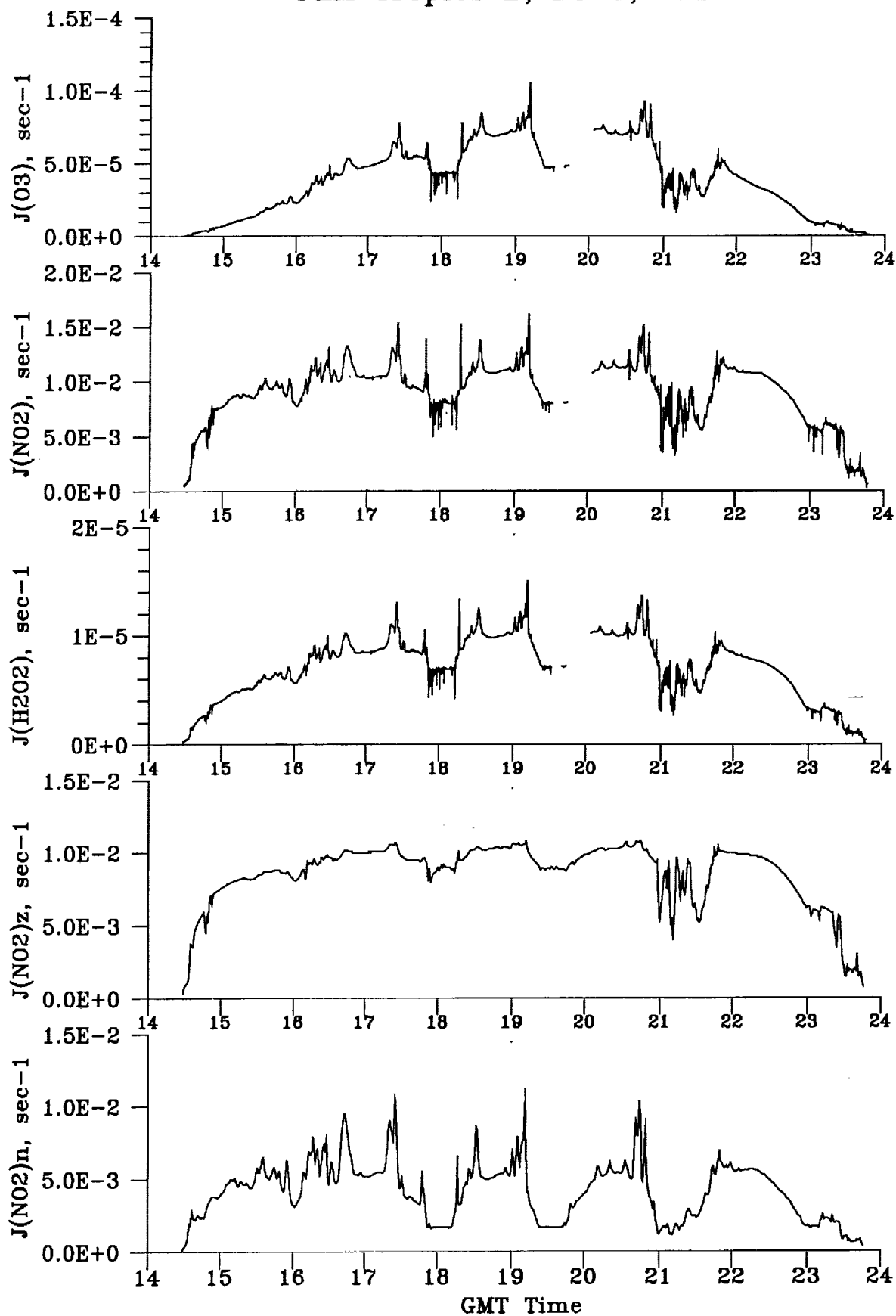
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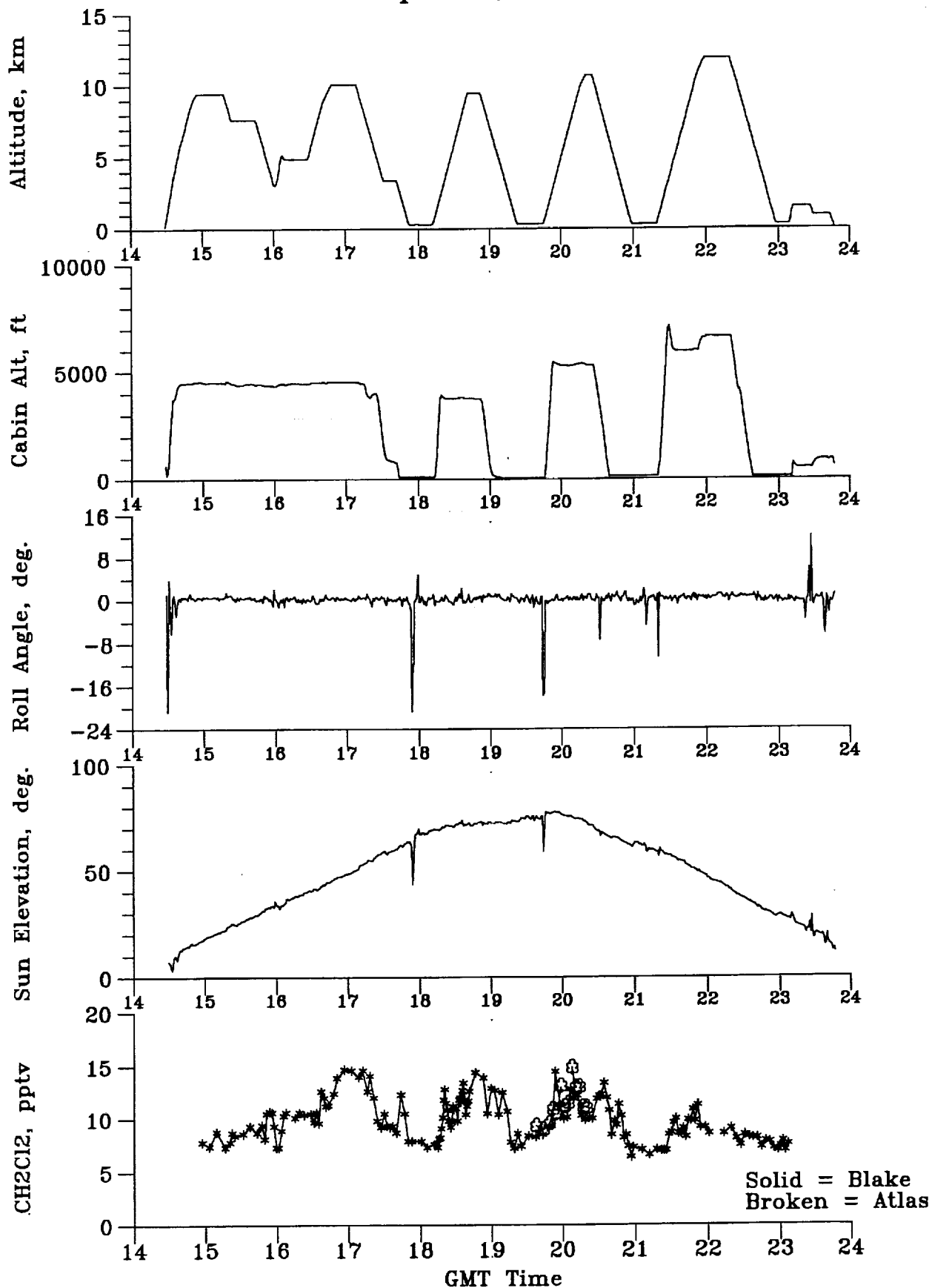
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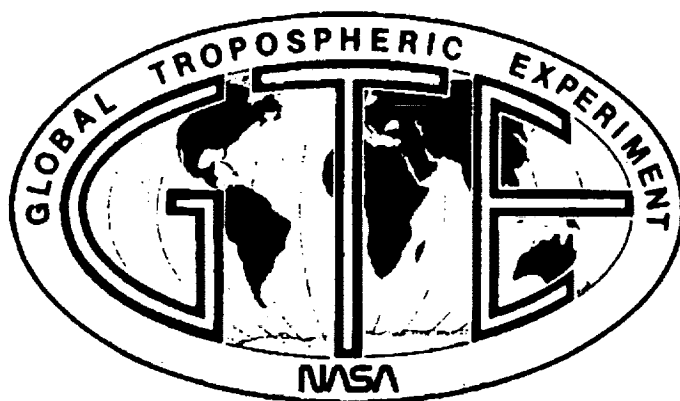
PEM Tropics B; DC-8; FLIGHT 20



PEM Tropics B; DC-8; FLIGHT 20



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

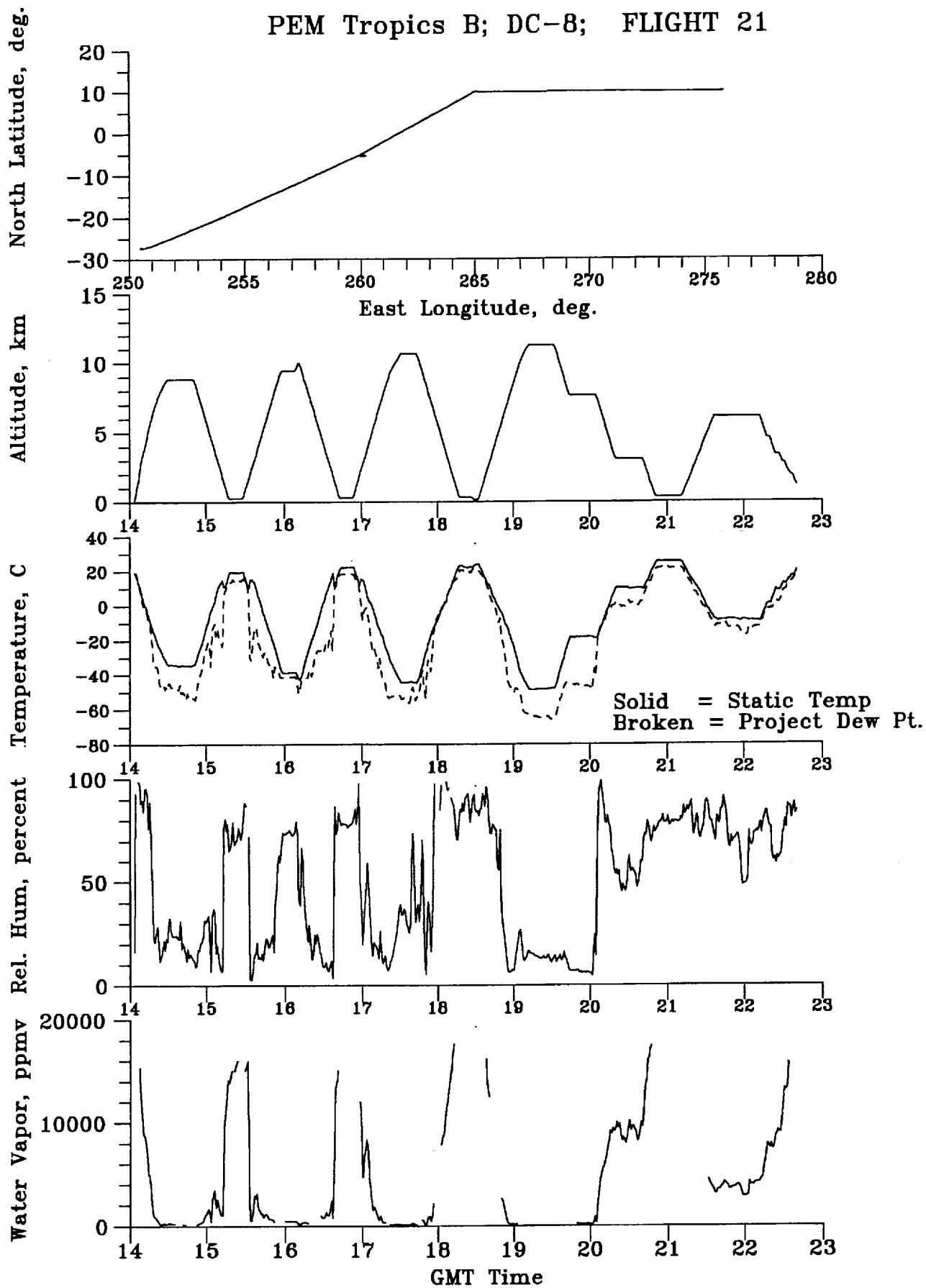
Flight 21D

Transit: Easter Island to Costa Rica

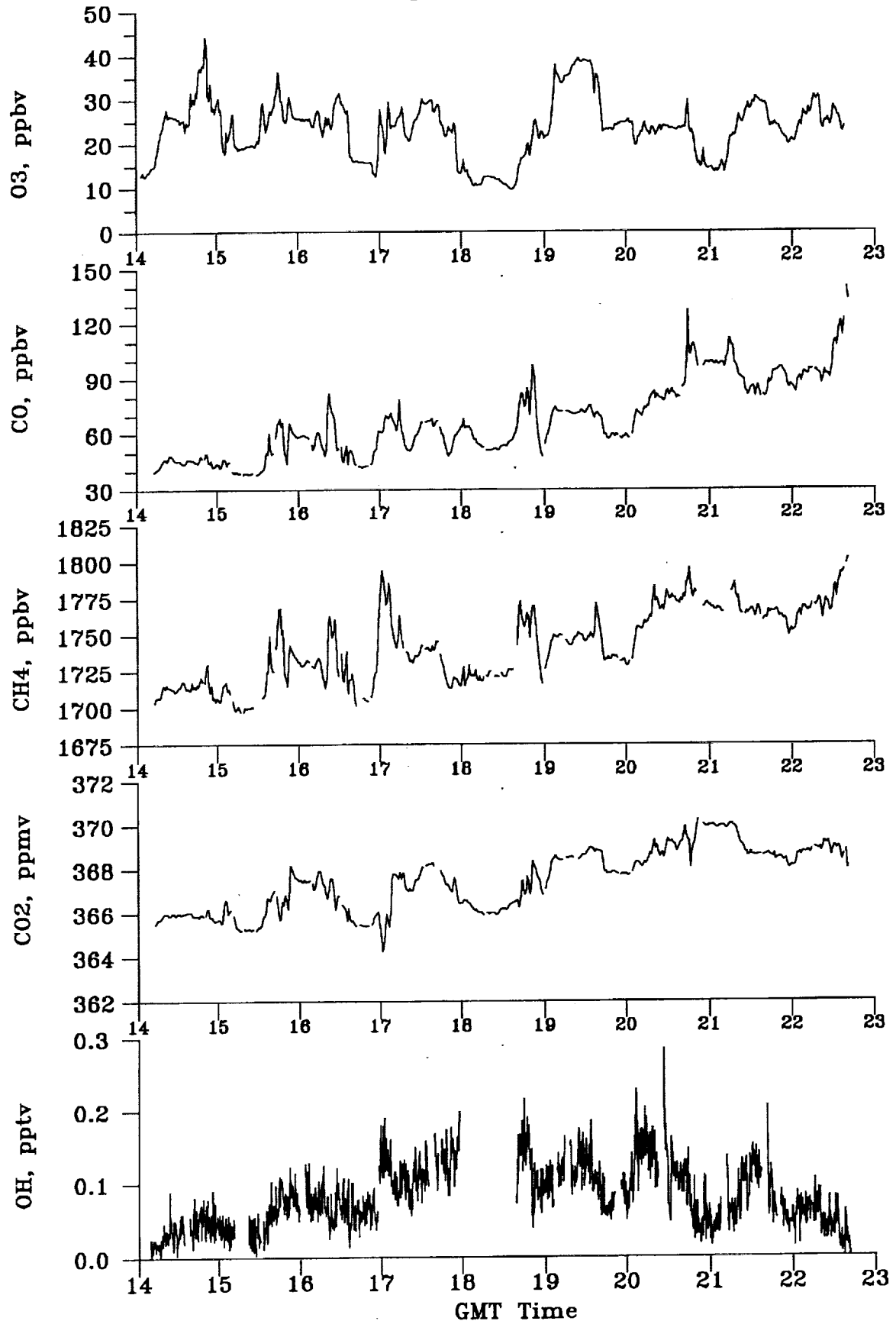
South/Central American Outflow

April 17, 1999

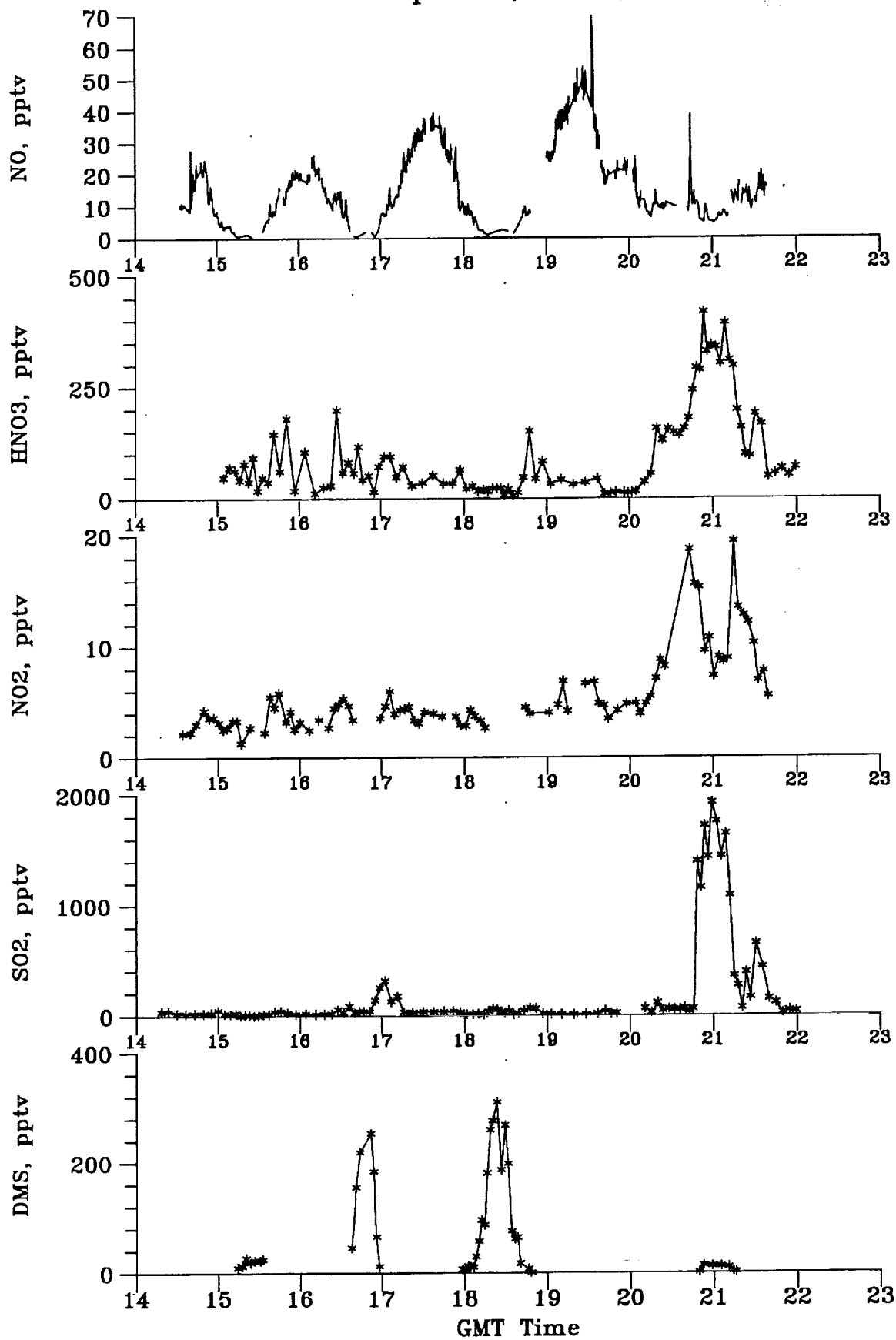
PEM Tropics B; DC-8; FLIGHT 21



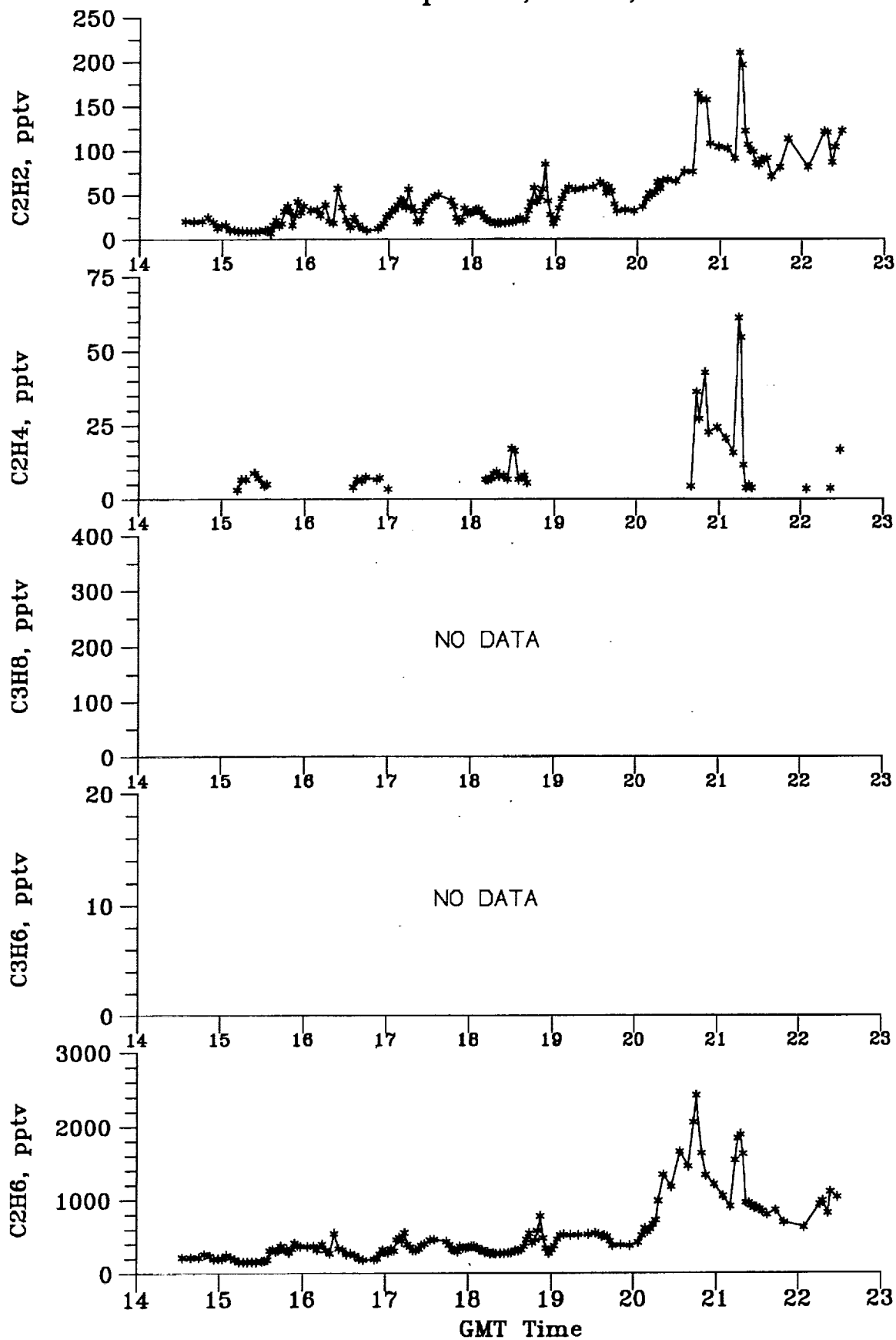
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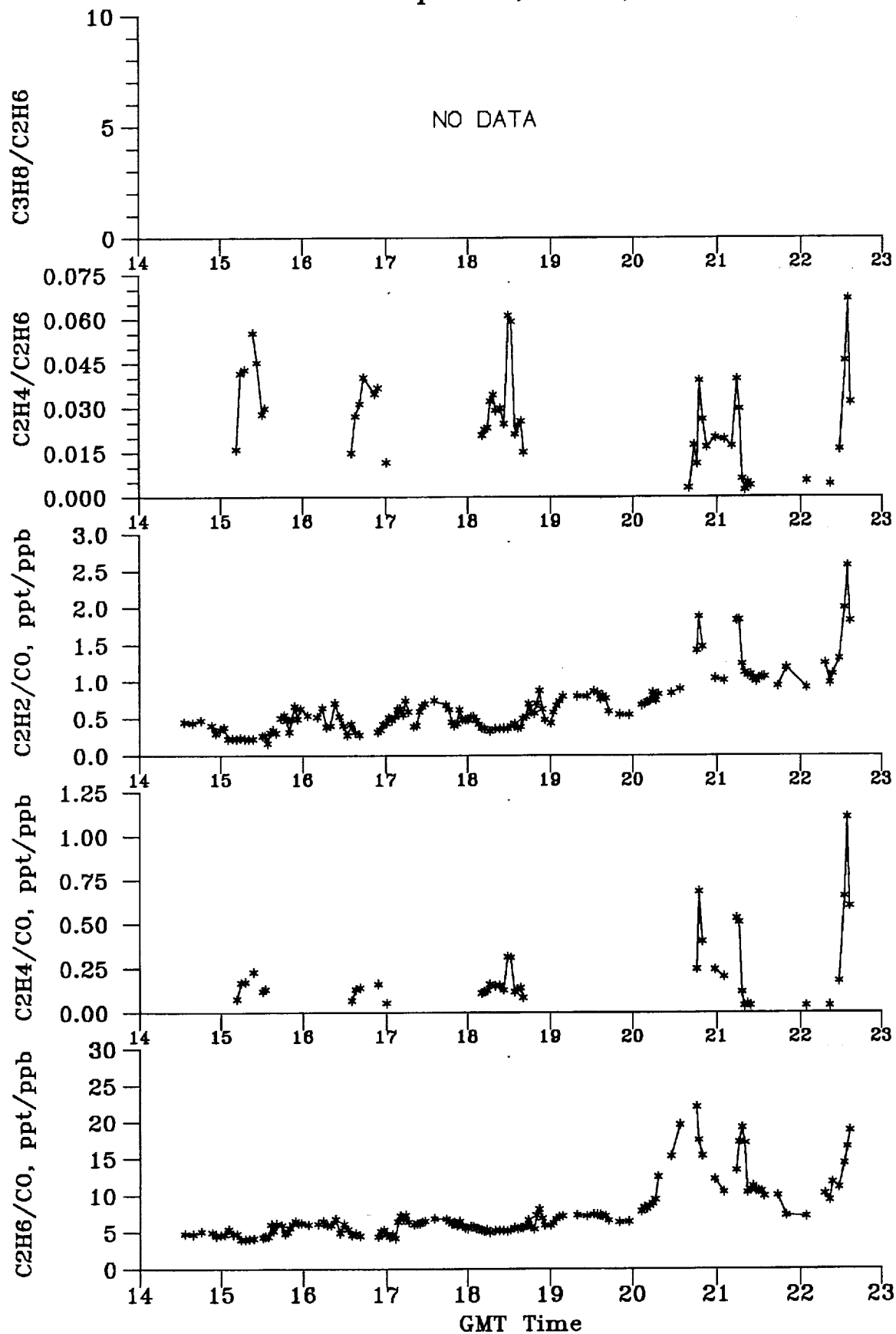
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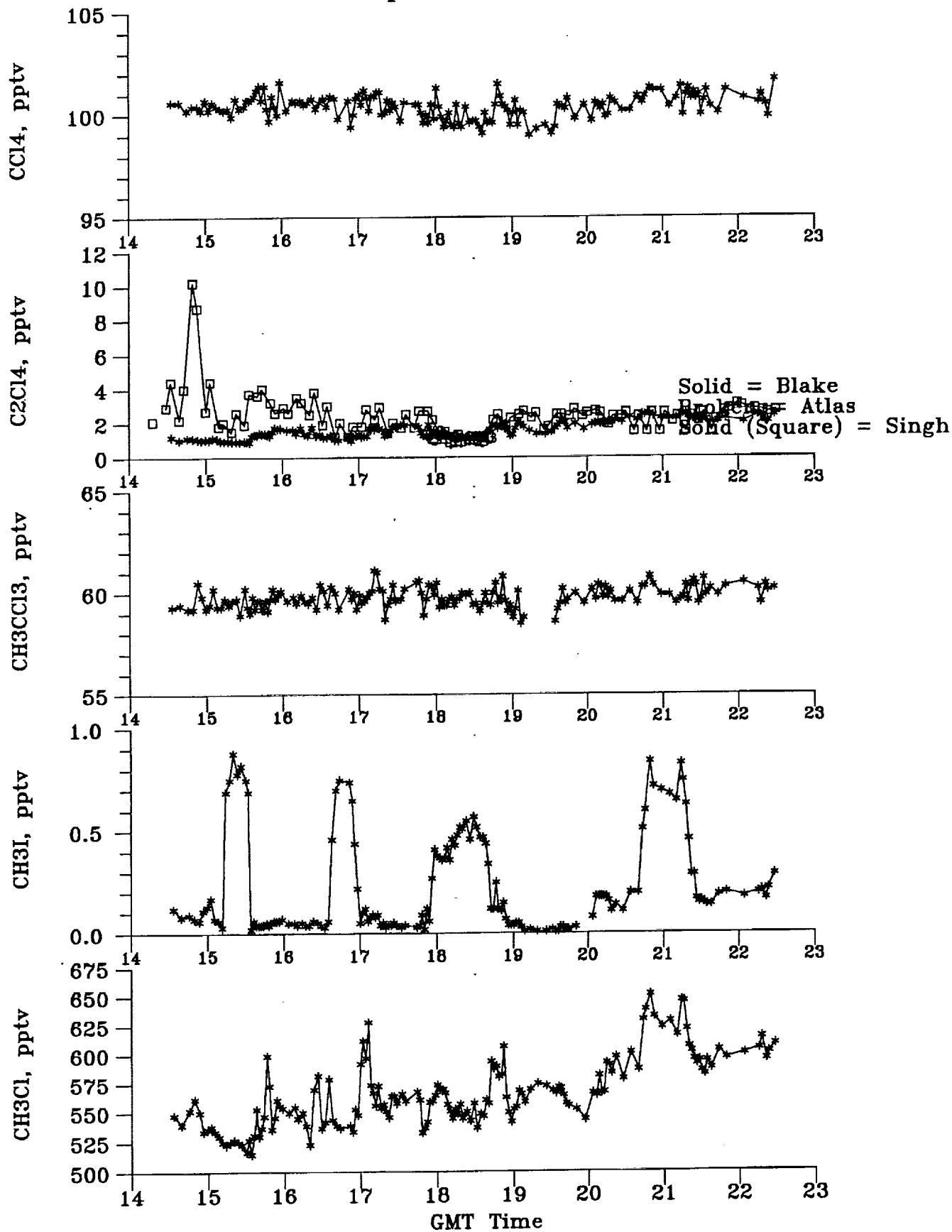
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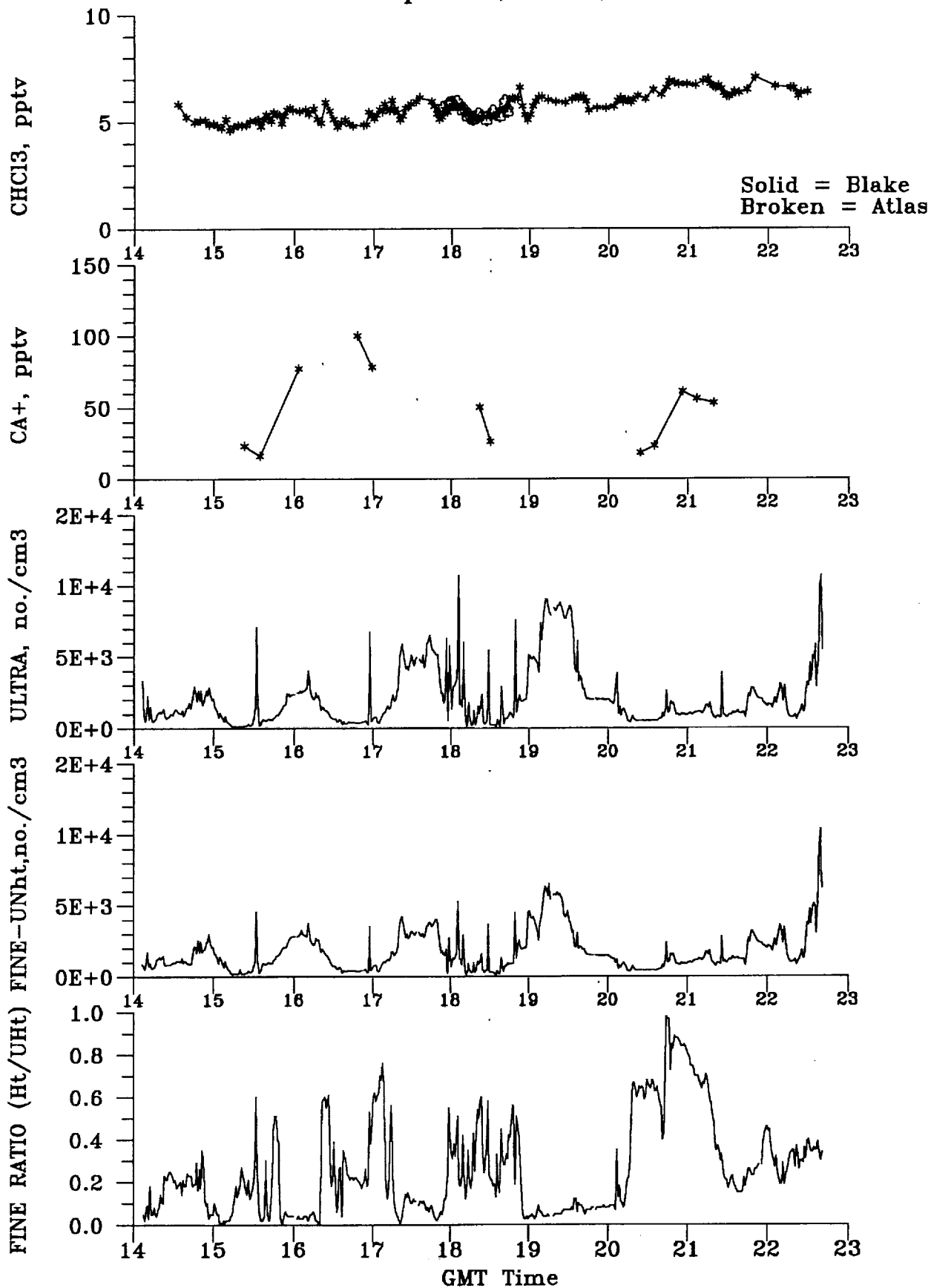
PEM Tropics B; DC-8; FLIGHT 21



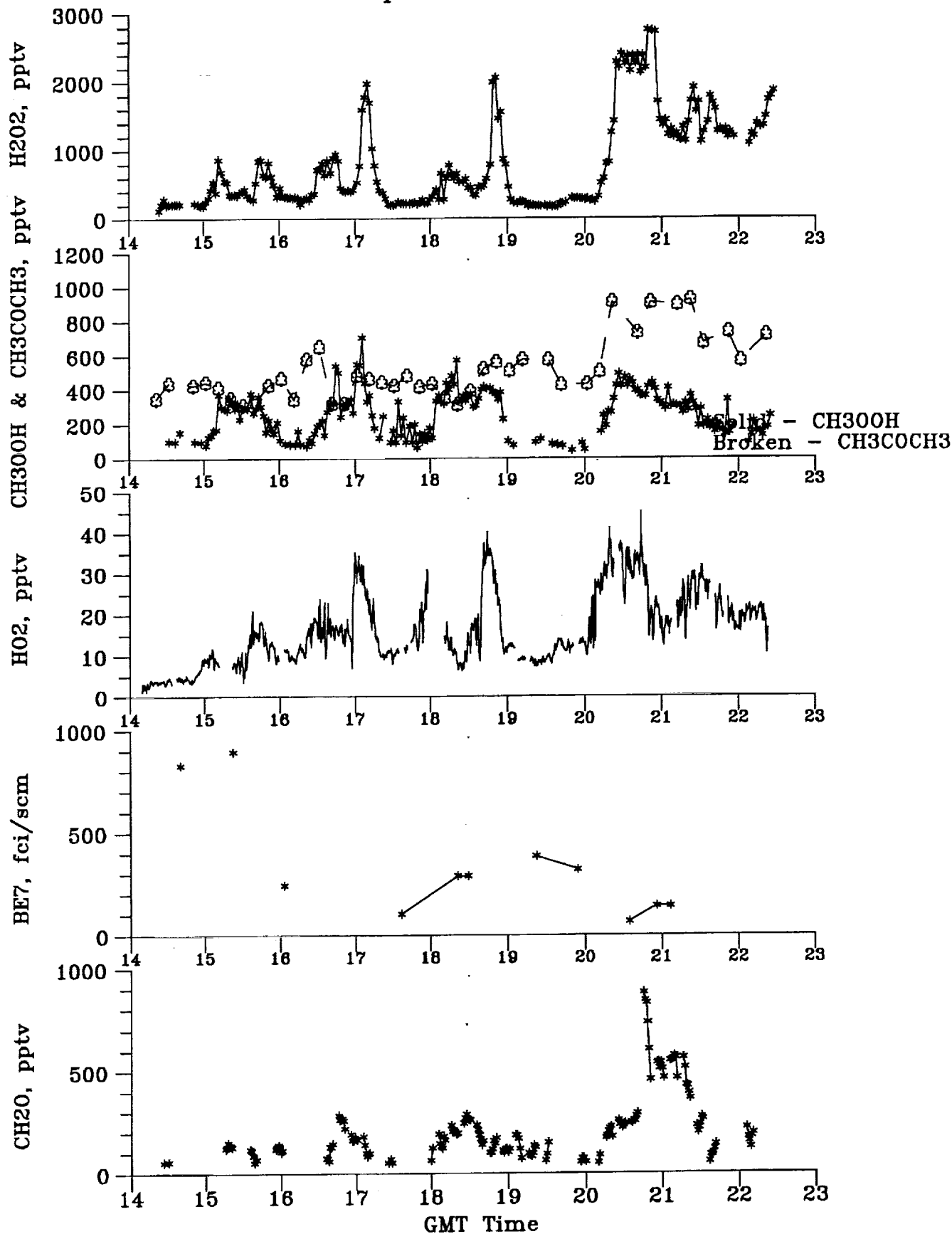
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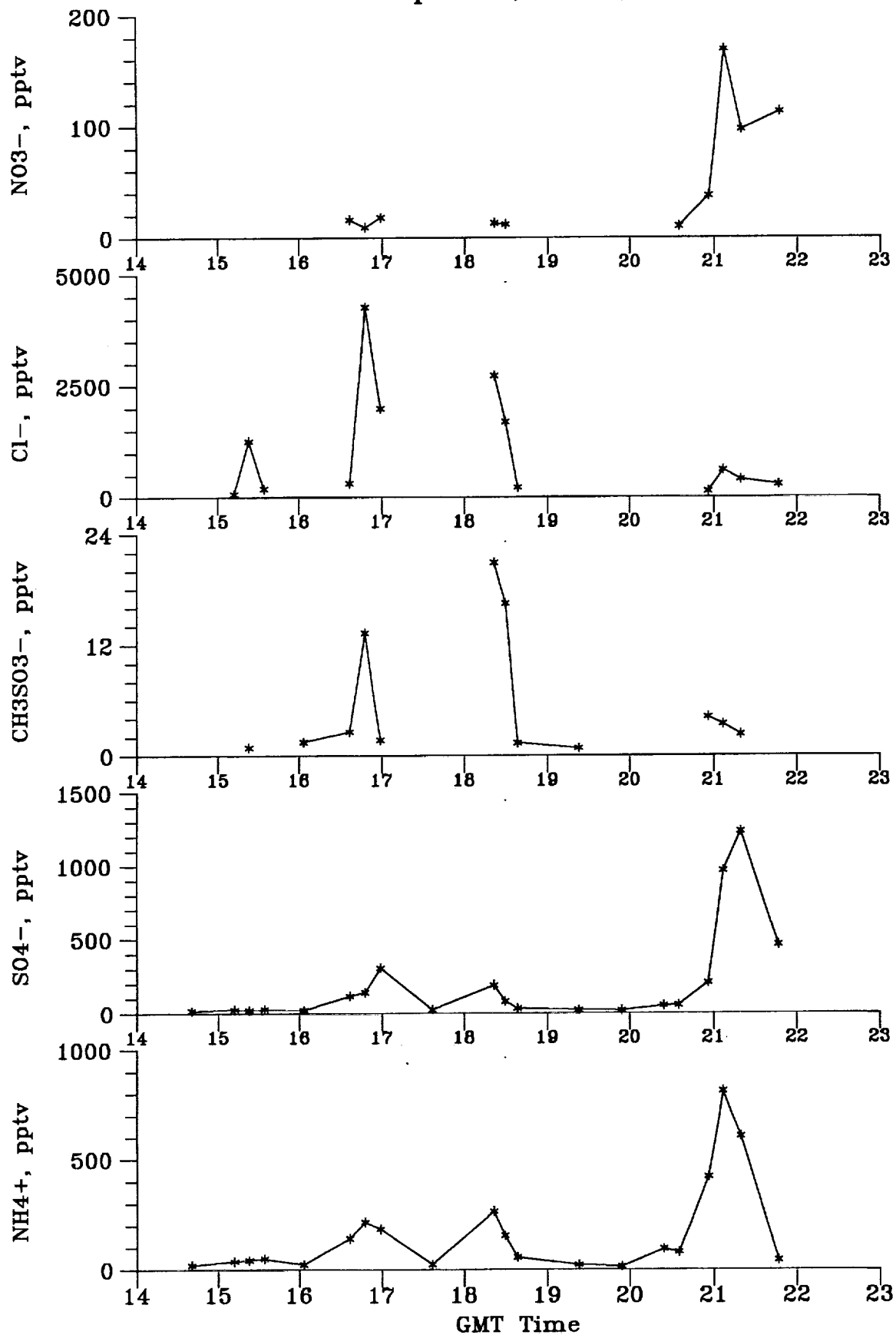
PEM Tropics B; DC-8; FLIGHT 21



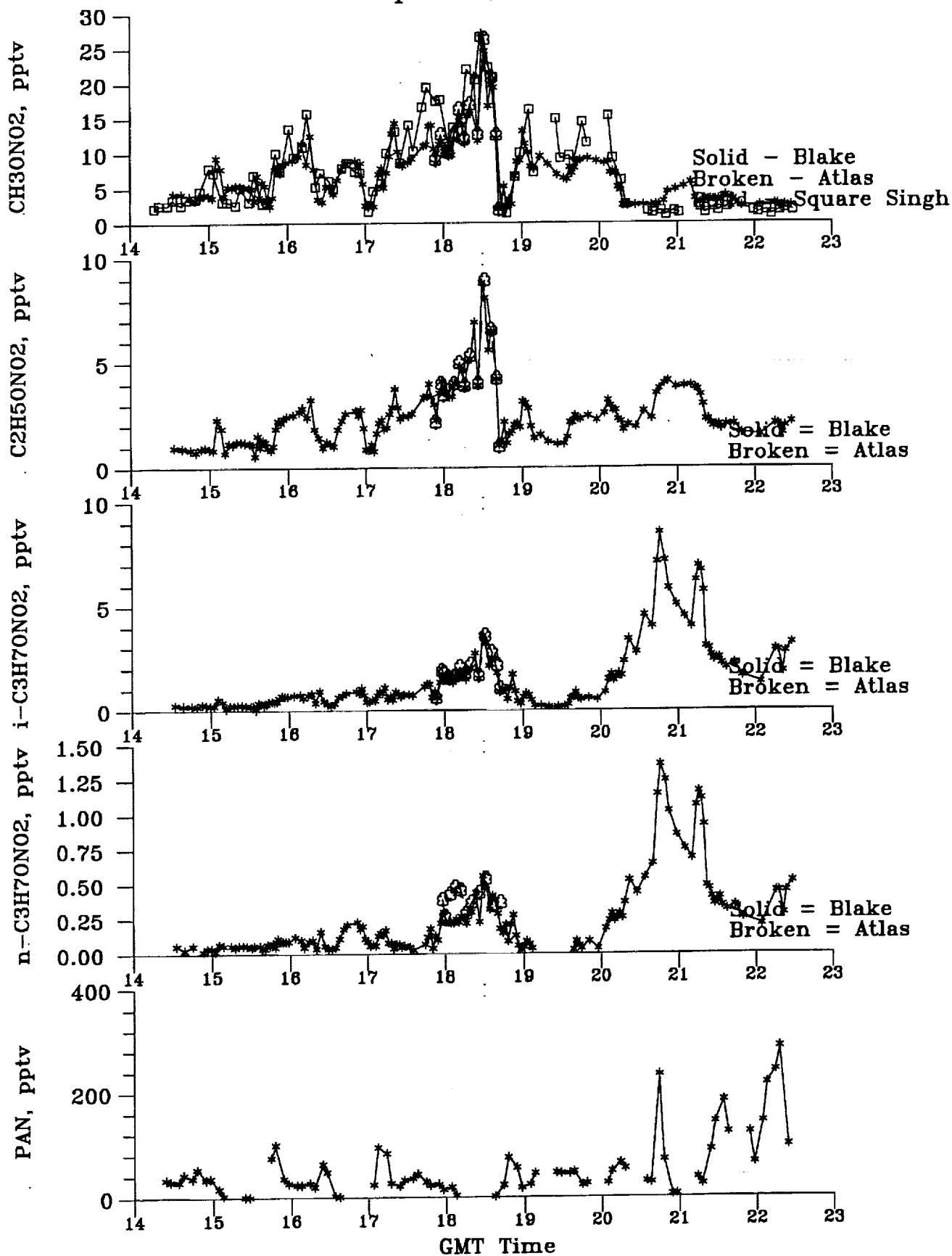
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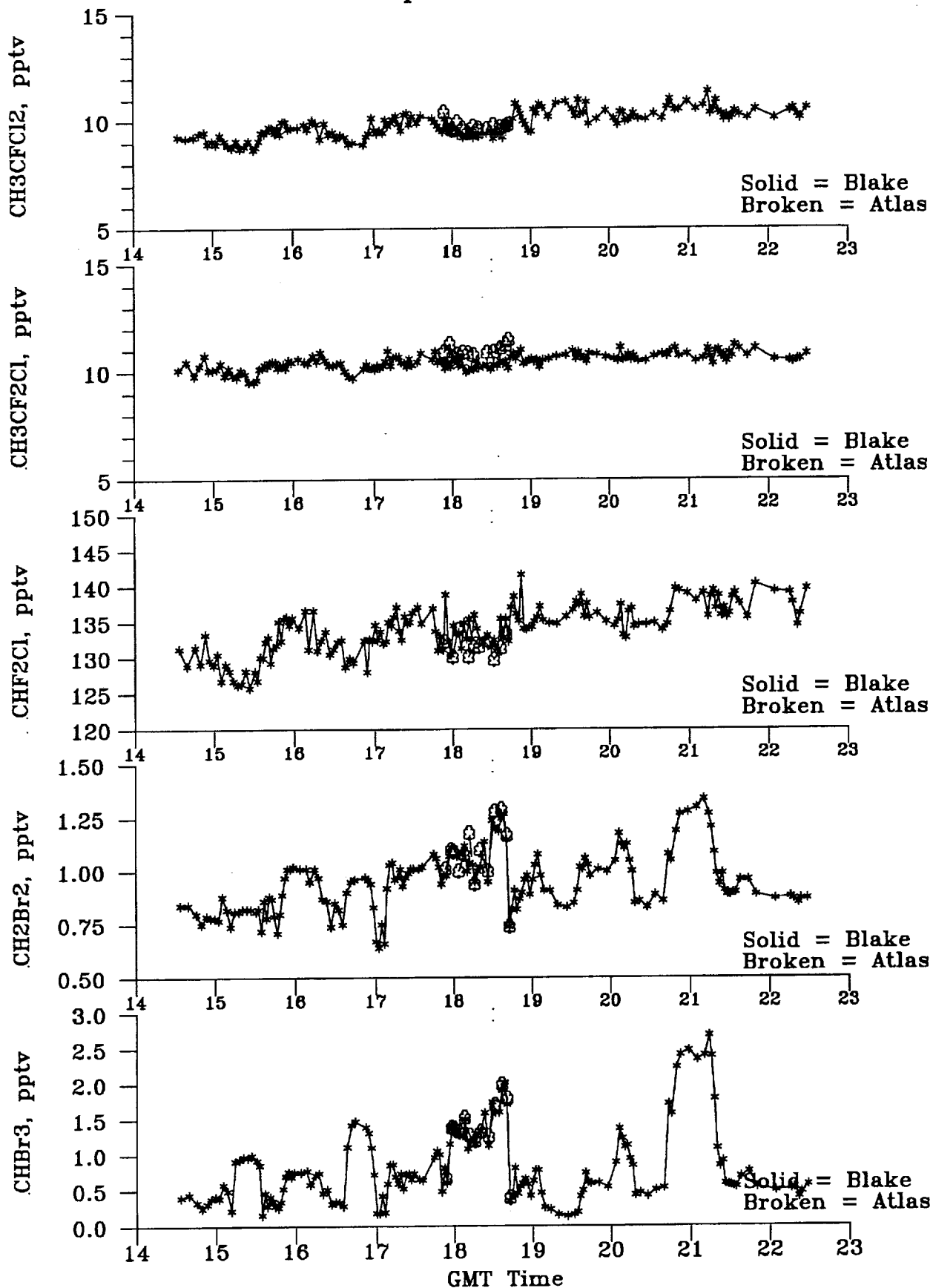
PEM Tropics B; DC-8; FLIGHT 21



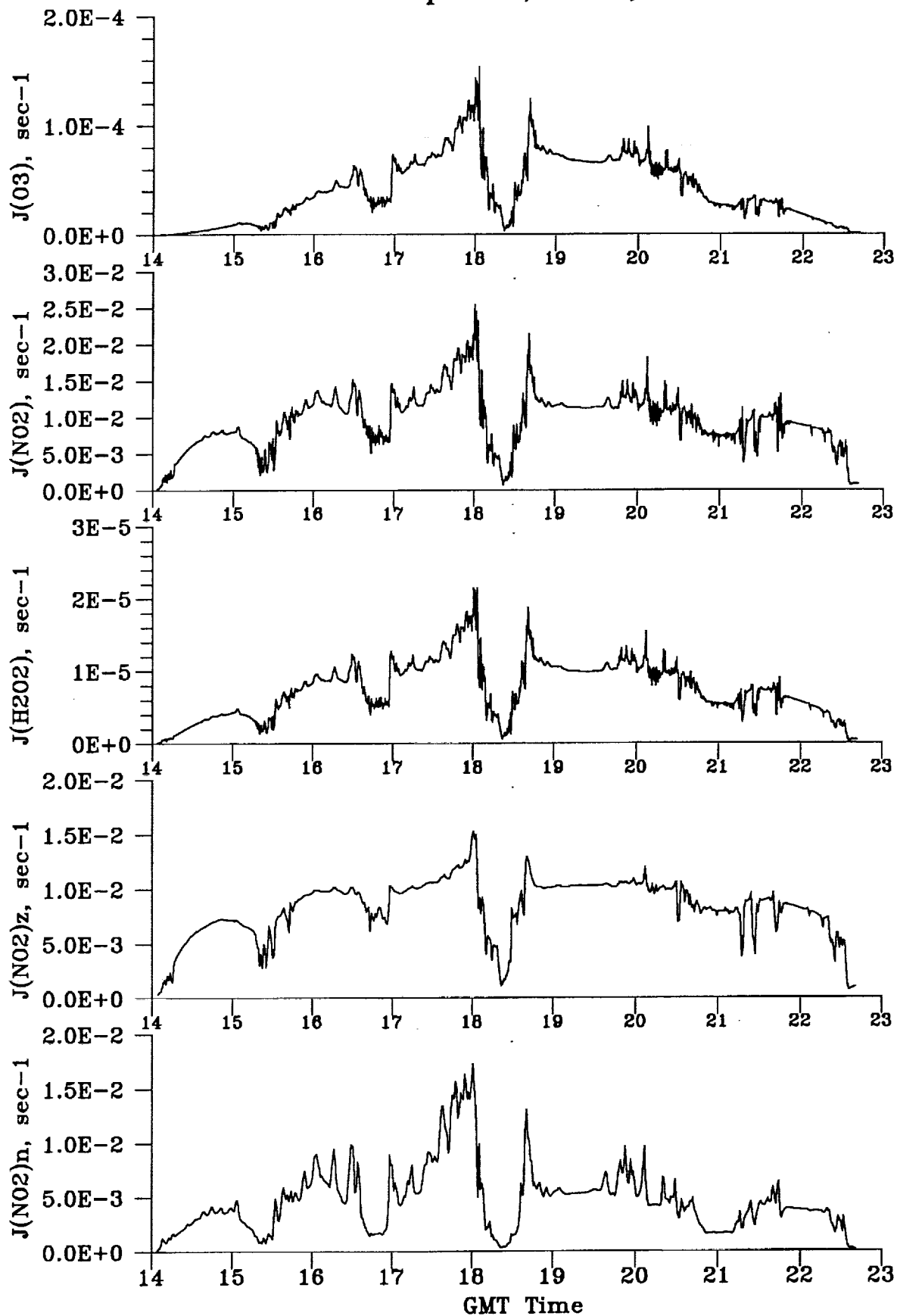
PEM Tropics B; DC-8; FLIGHT 21



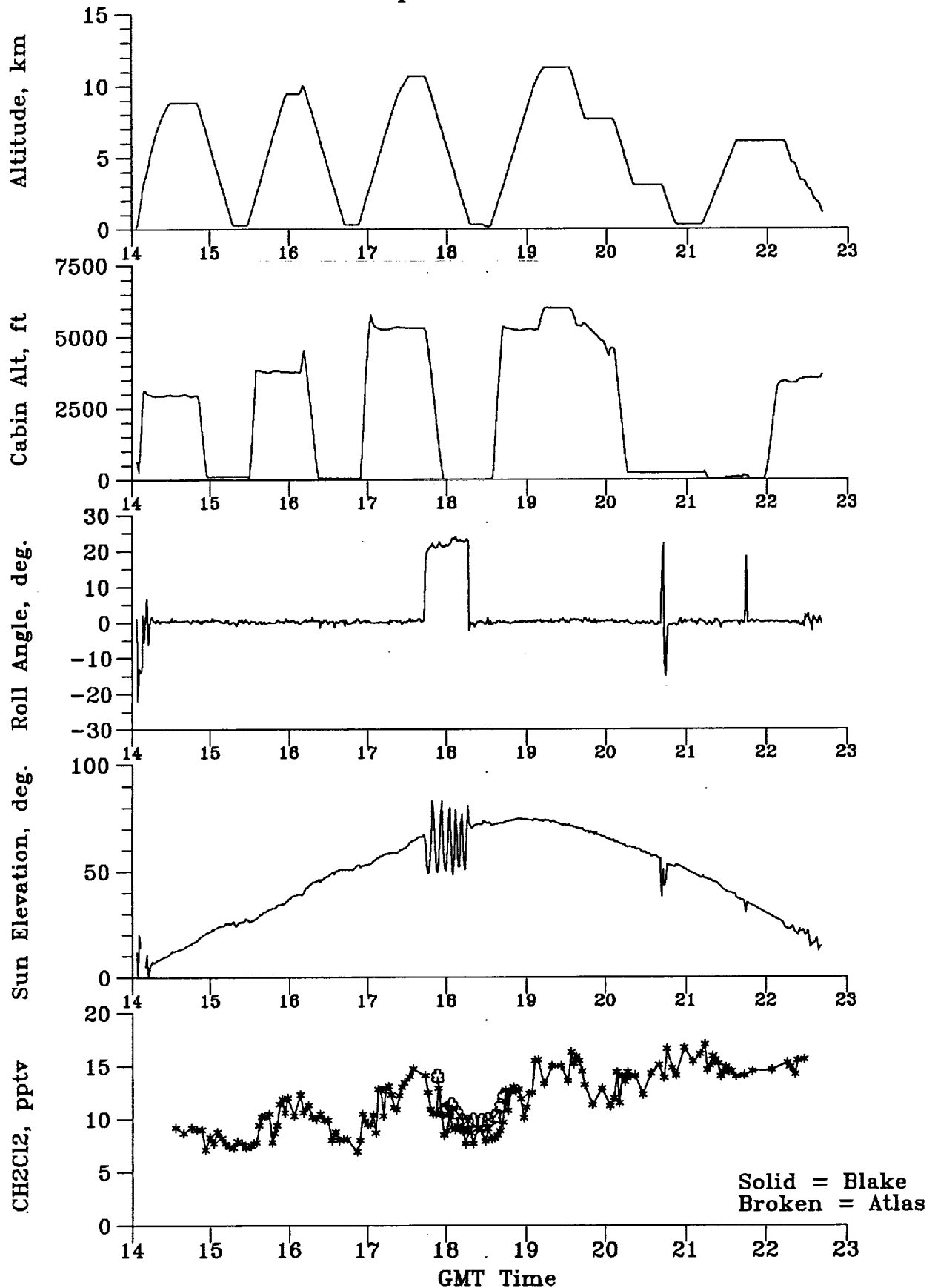
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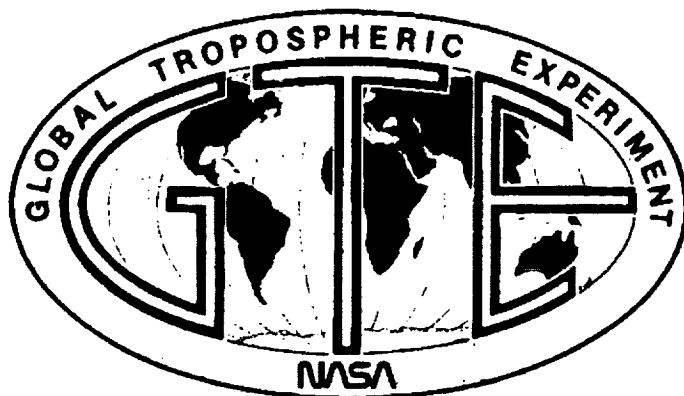
PEM Tropics B; DC-8; FLIGHT 21



PEM Tropics B; DC-8; FLIGHT 21



PLOTS OF FINAL CHEMICAL DATA



PEM-TROPICS B

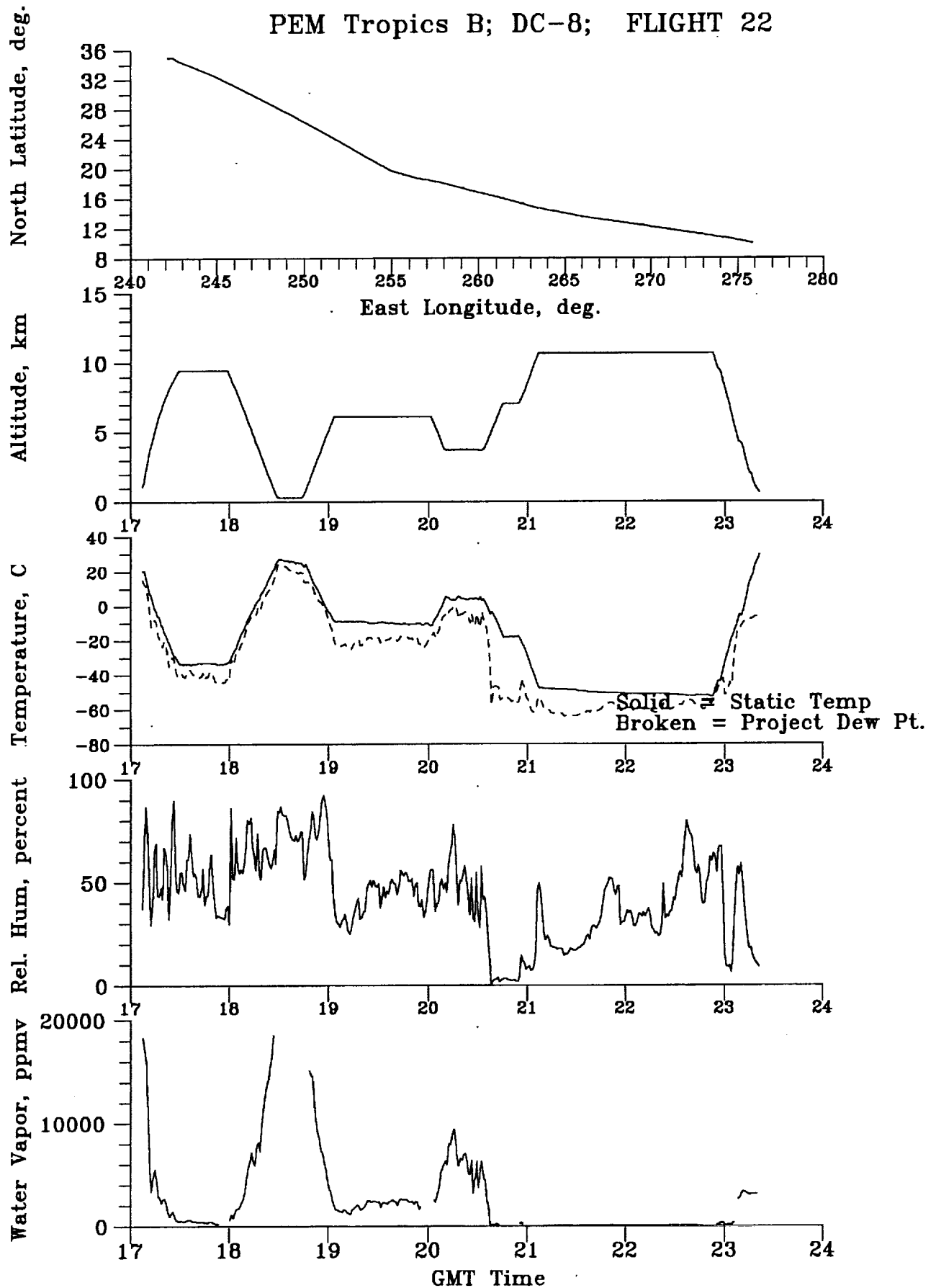
Flight 22D

Transit: Costa Rica to NASA DFRC

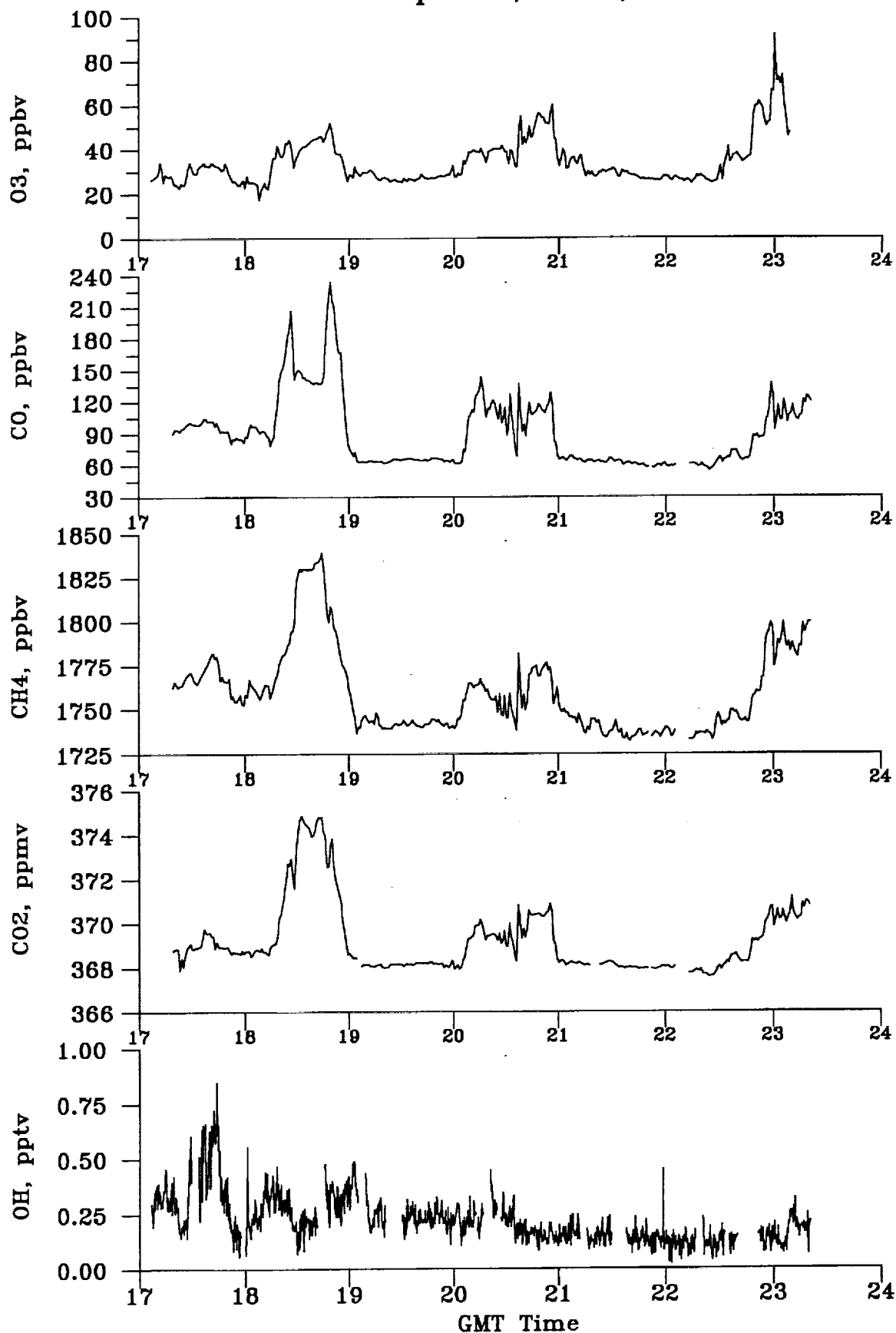
Central American Outflow

April 18, 1999

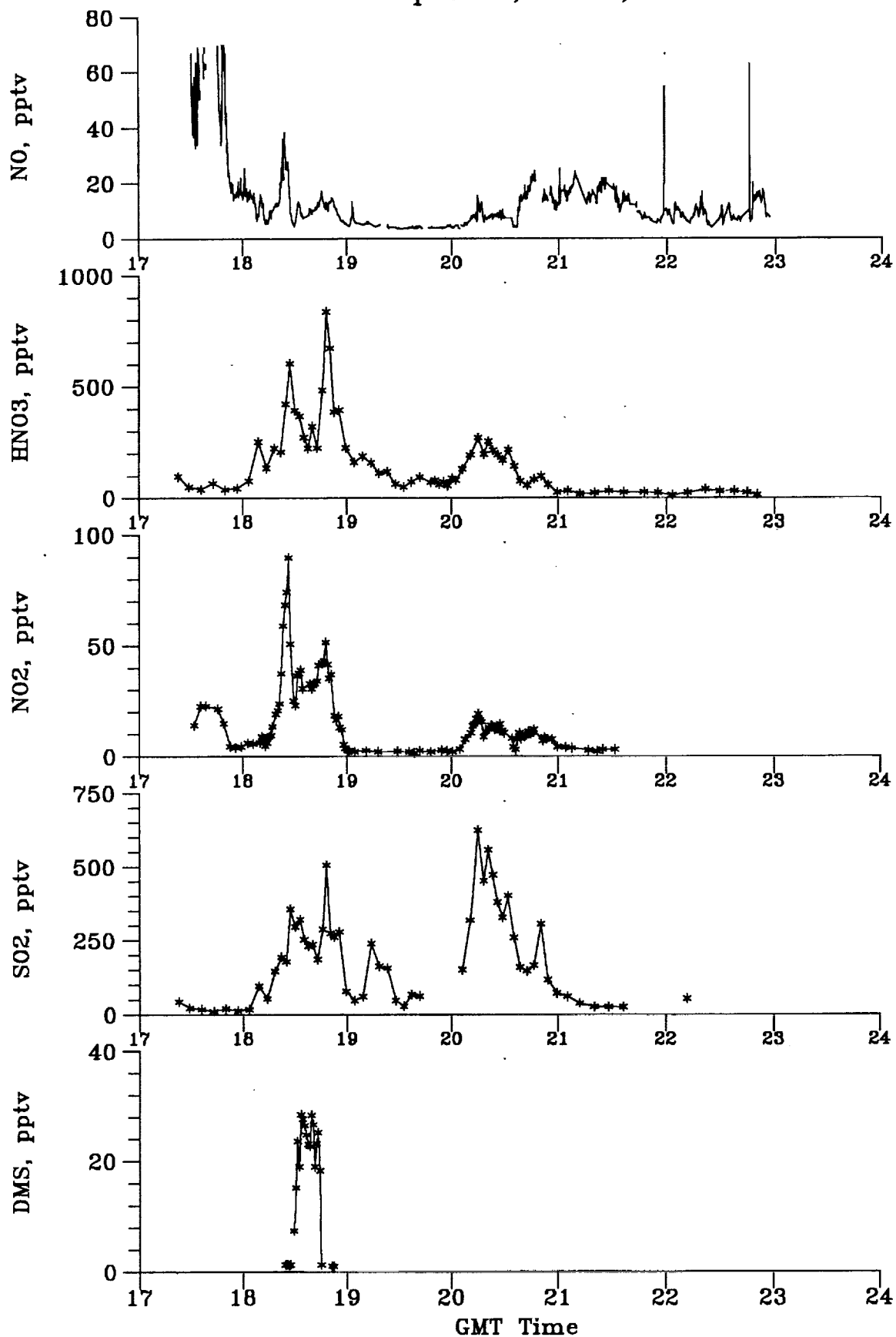
PEM Tropics B; DC-8; FLIGHT 22



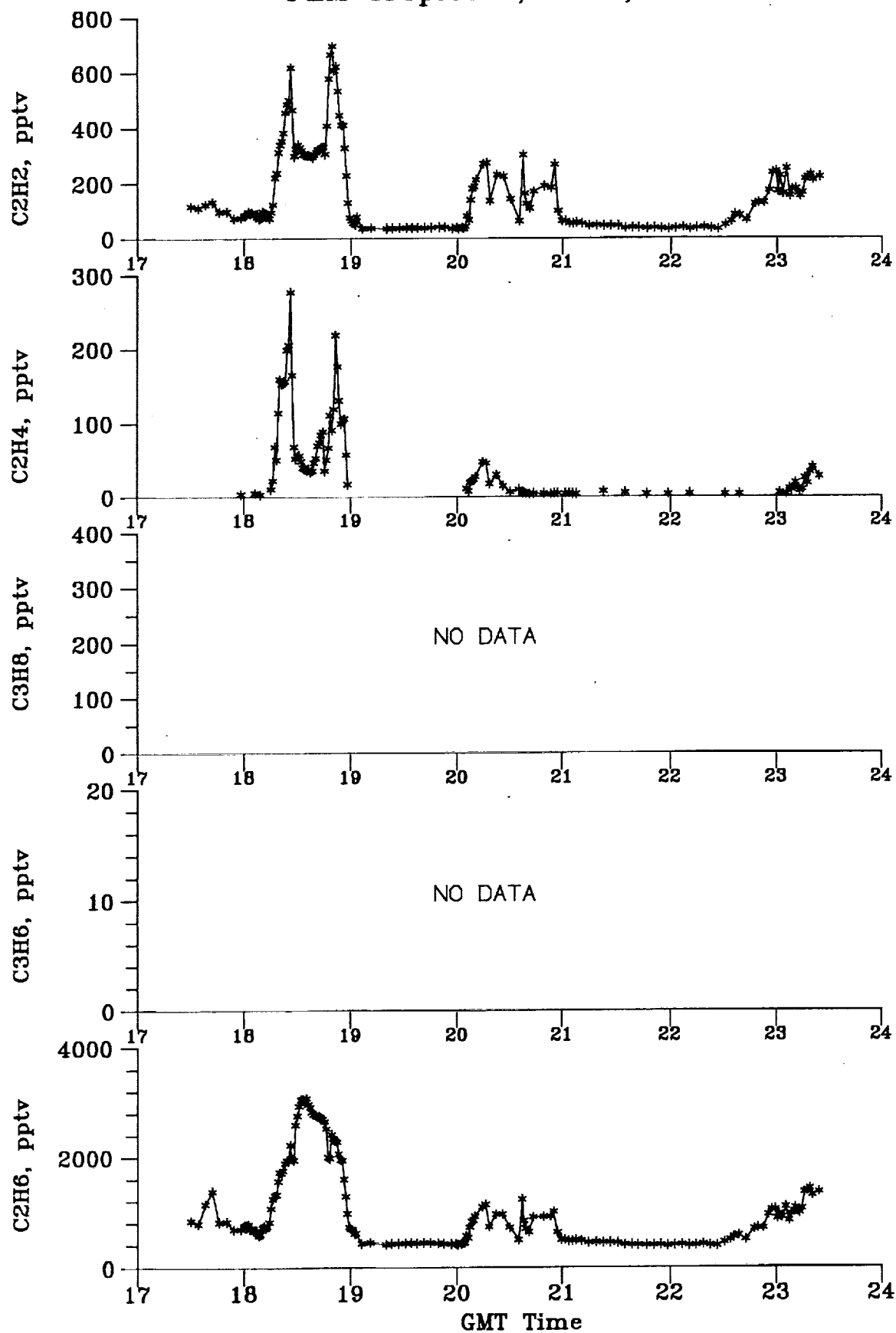
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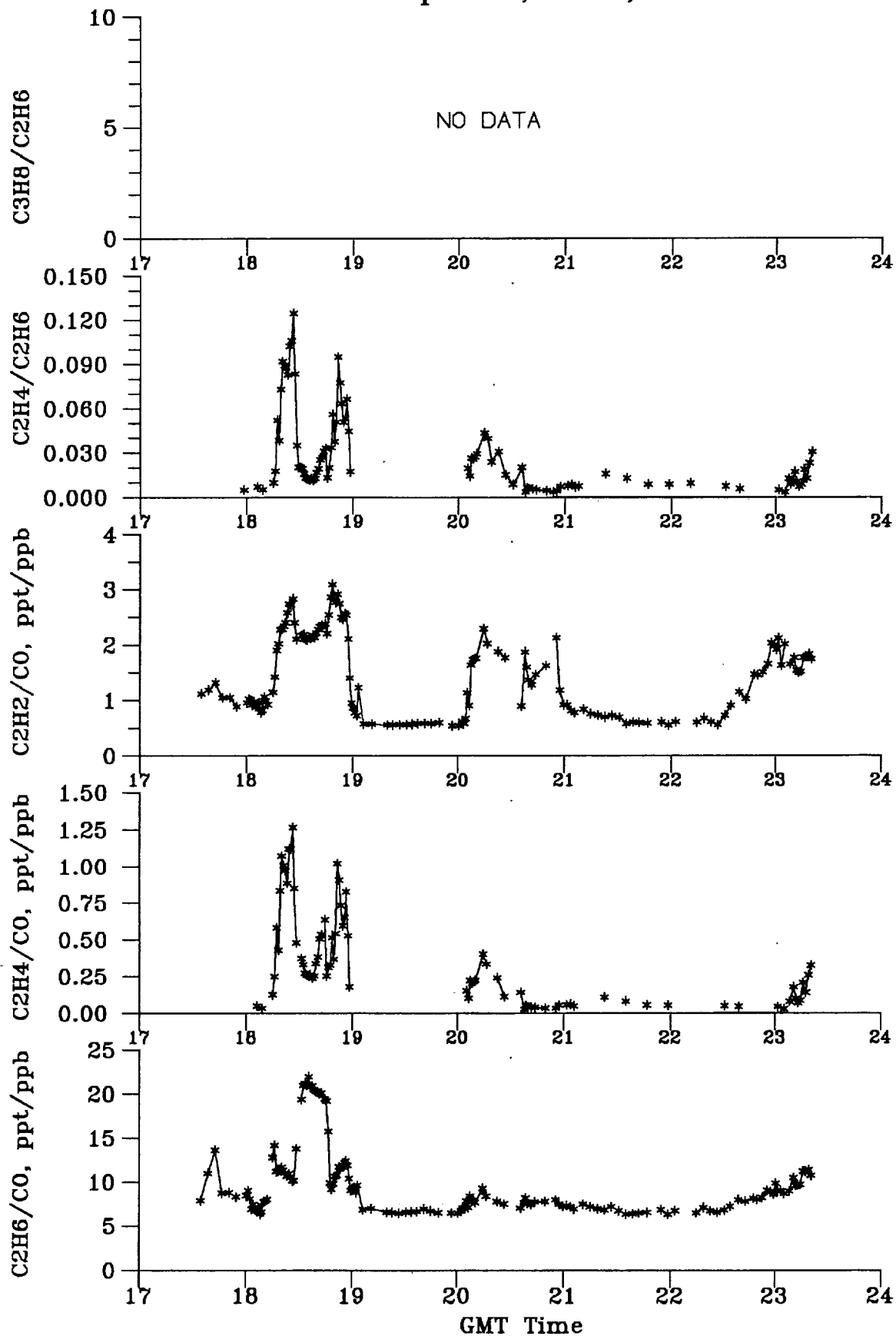
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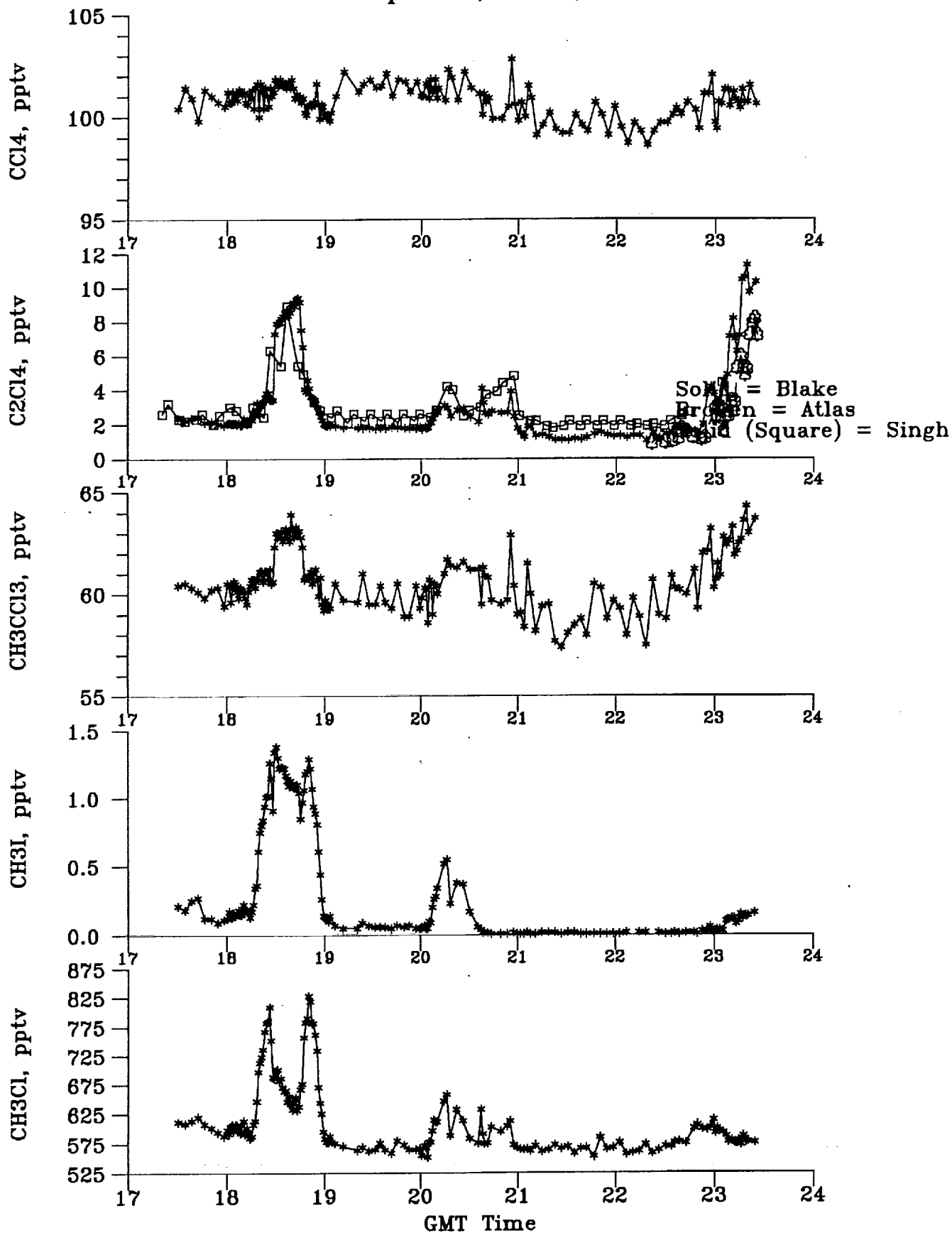
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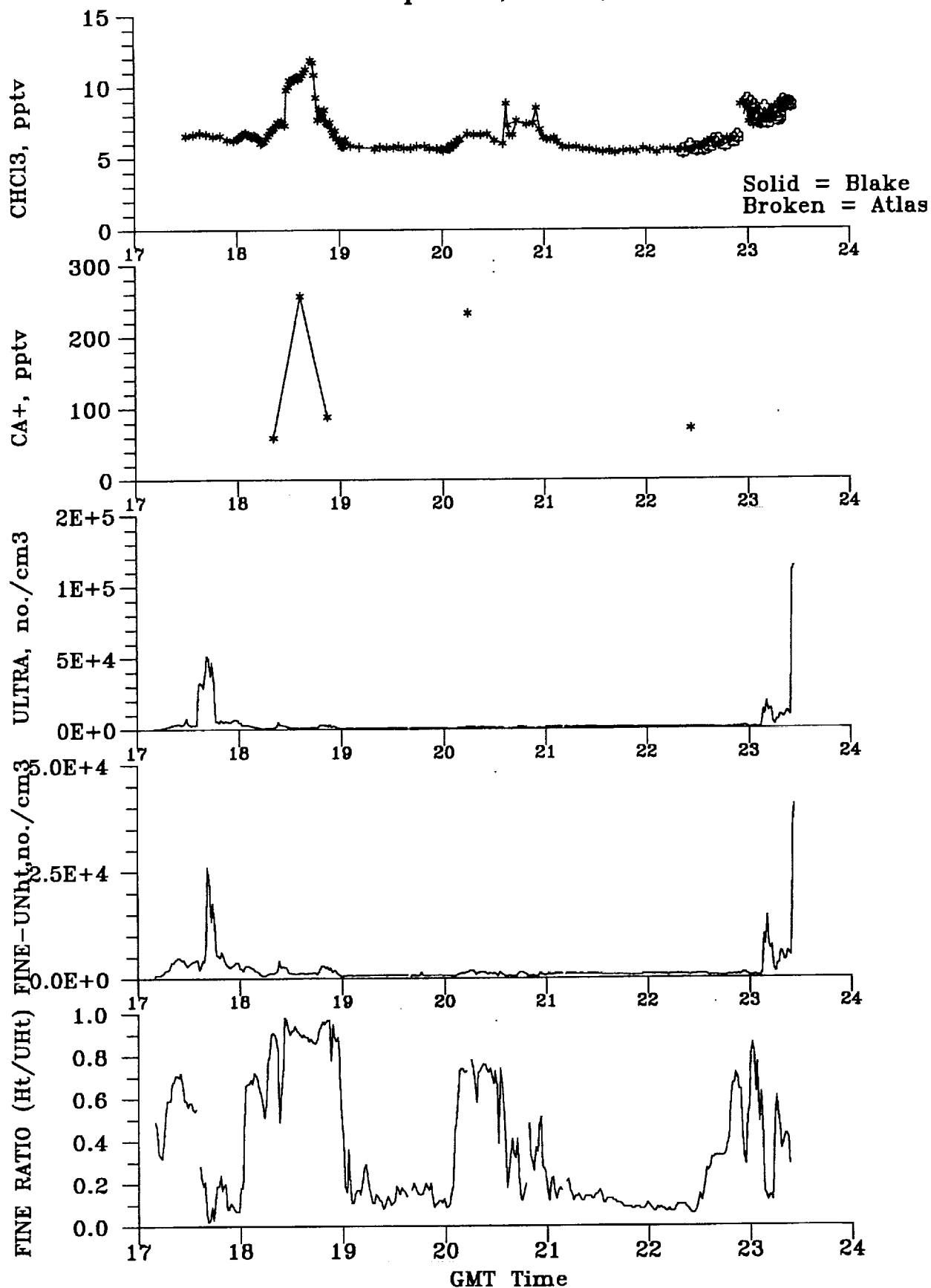
PEM Tropics B; DC-8; FLIGHT 22



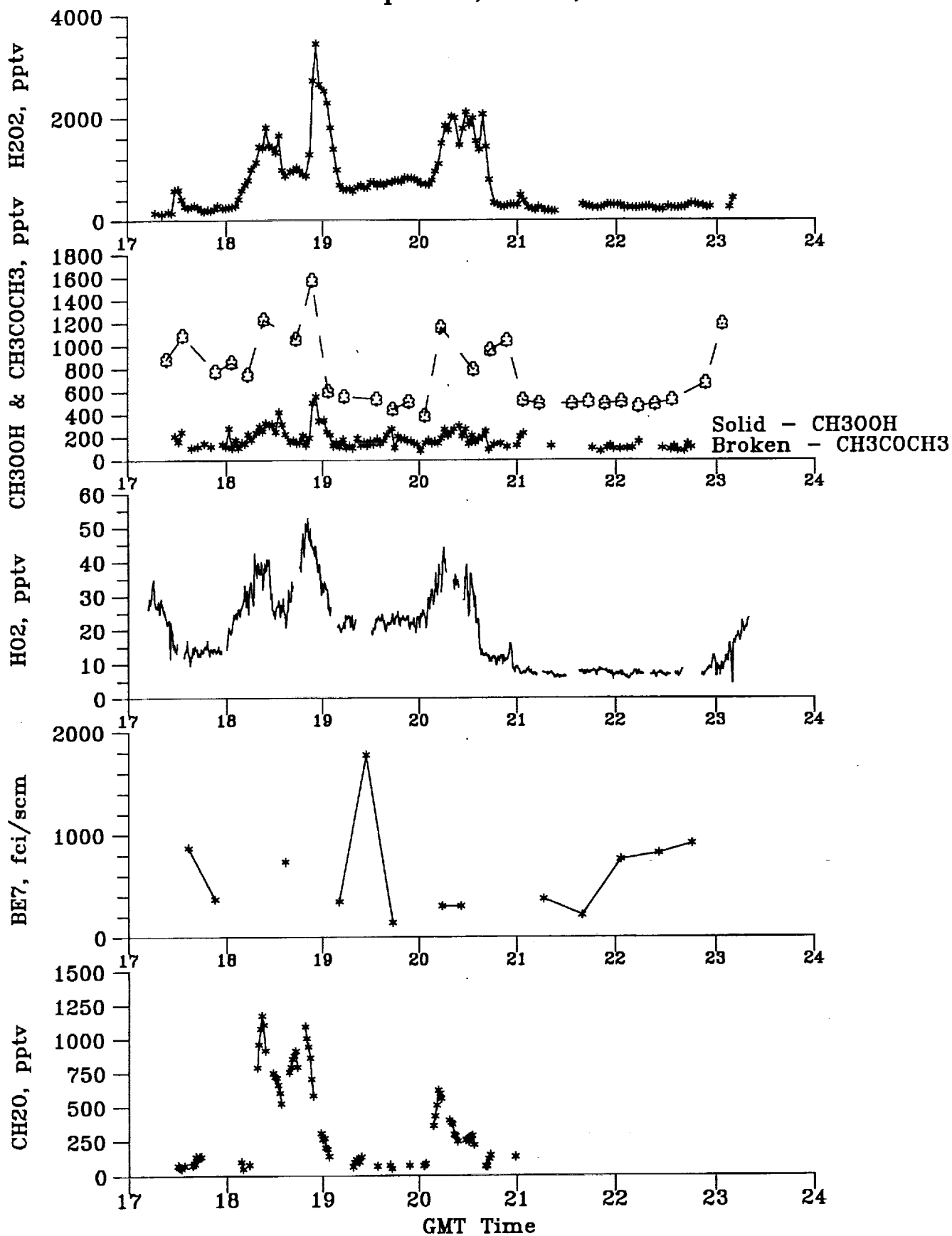
PEM Tropics B; DC-8; FLIGHT 22



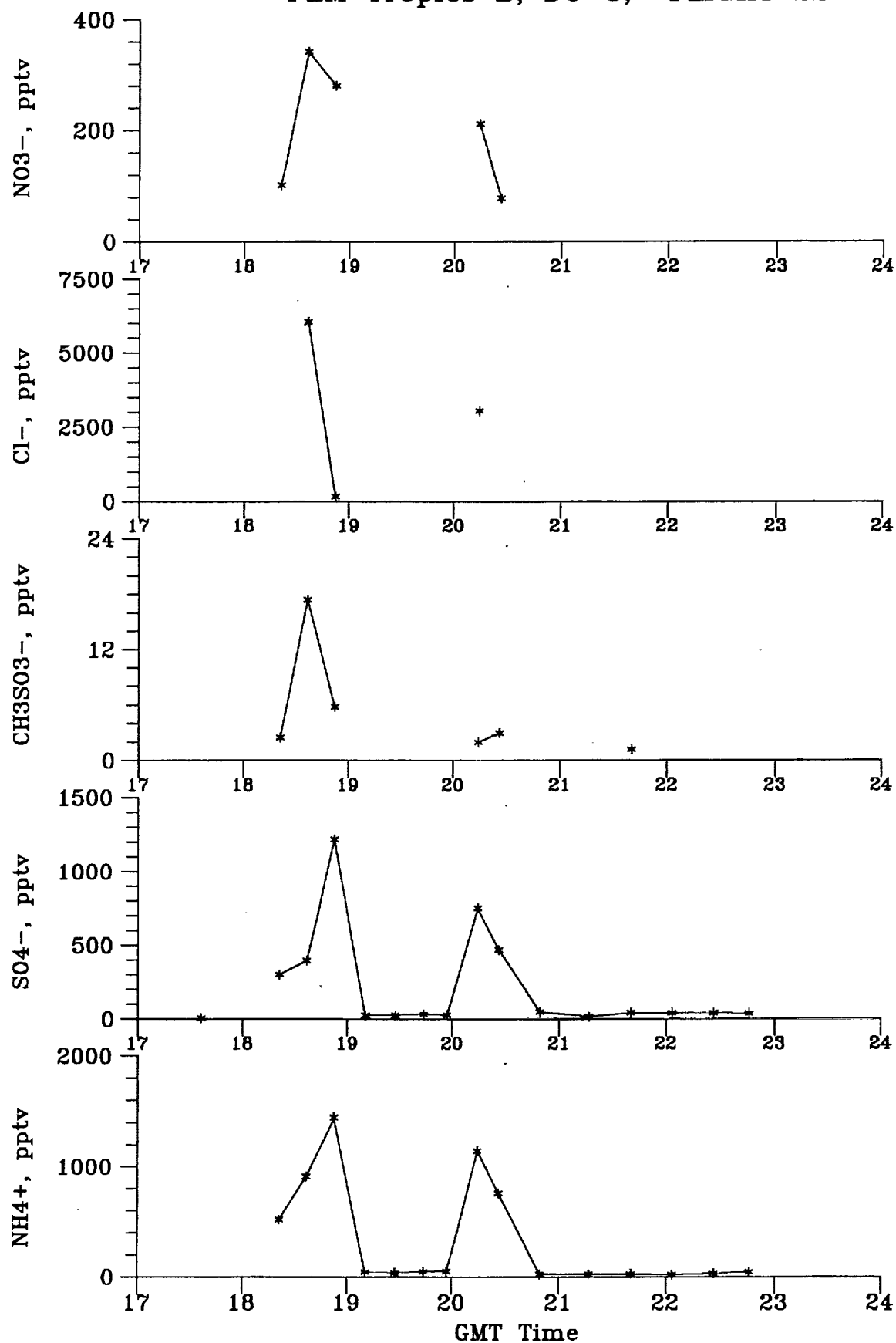
PEM Tropics B; DC-8; FLIGHT 22



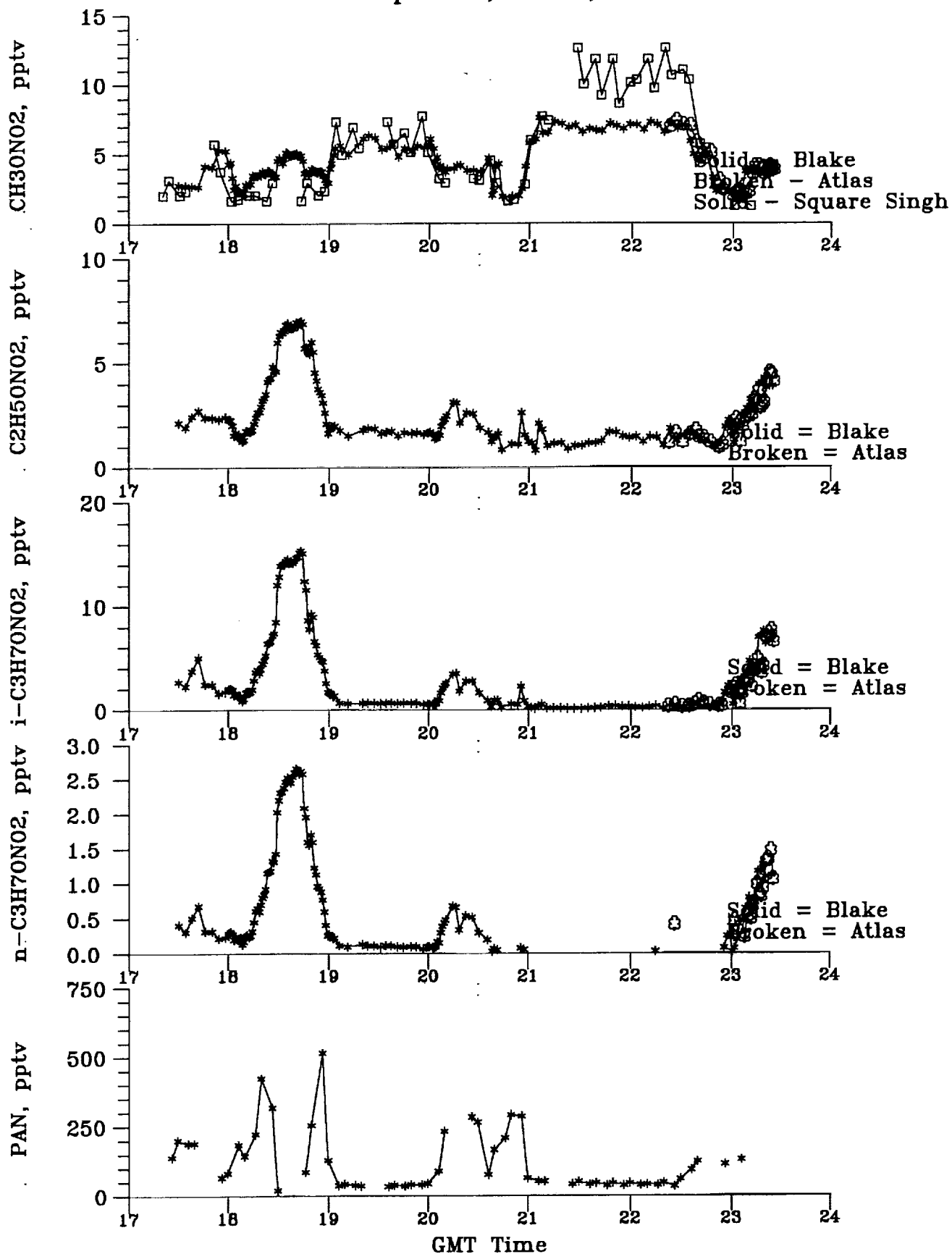
PEM Tropics B; DC-8; FLIGHT 22



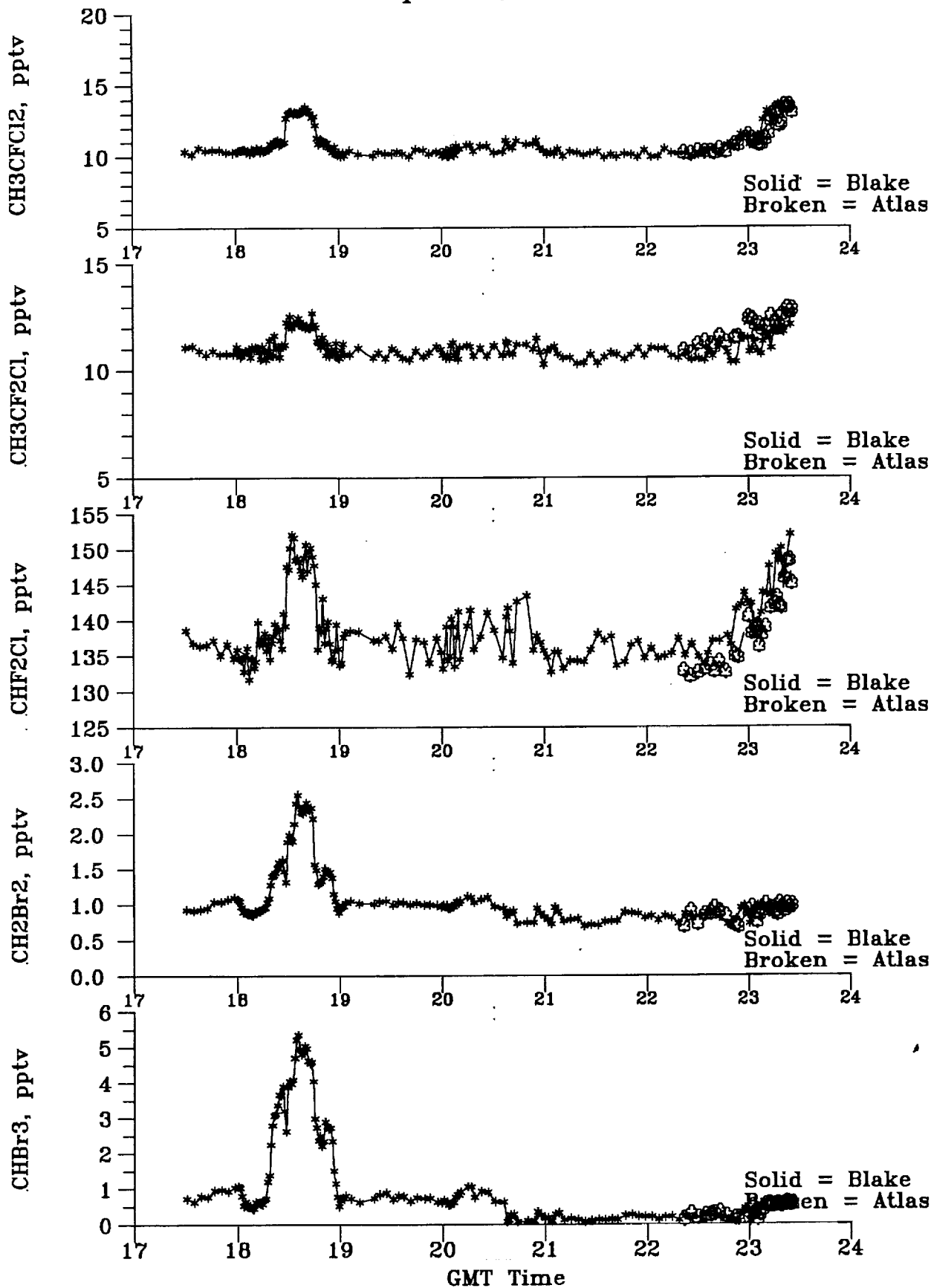
PEM Tropics B; DC-8; FLIGHT 22



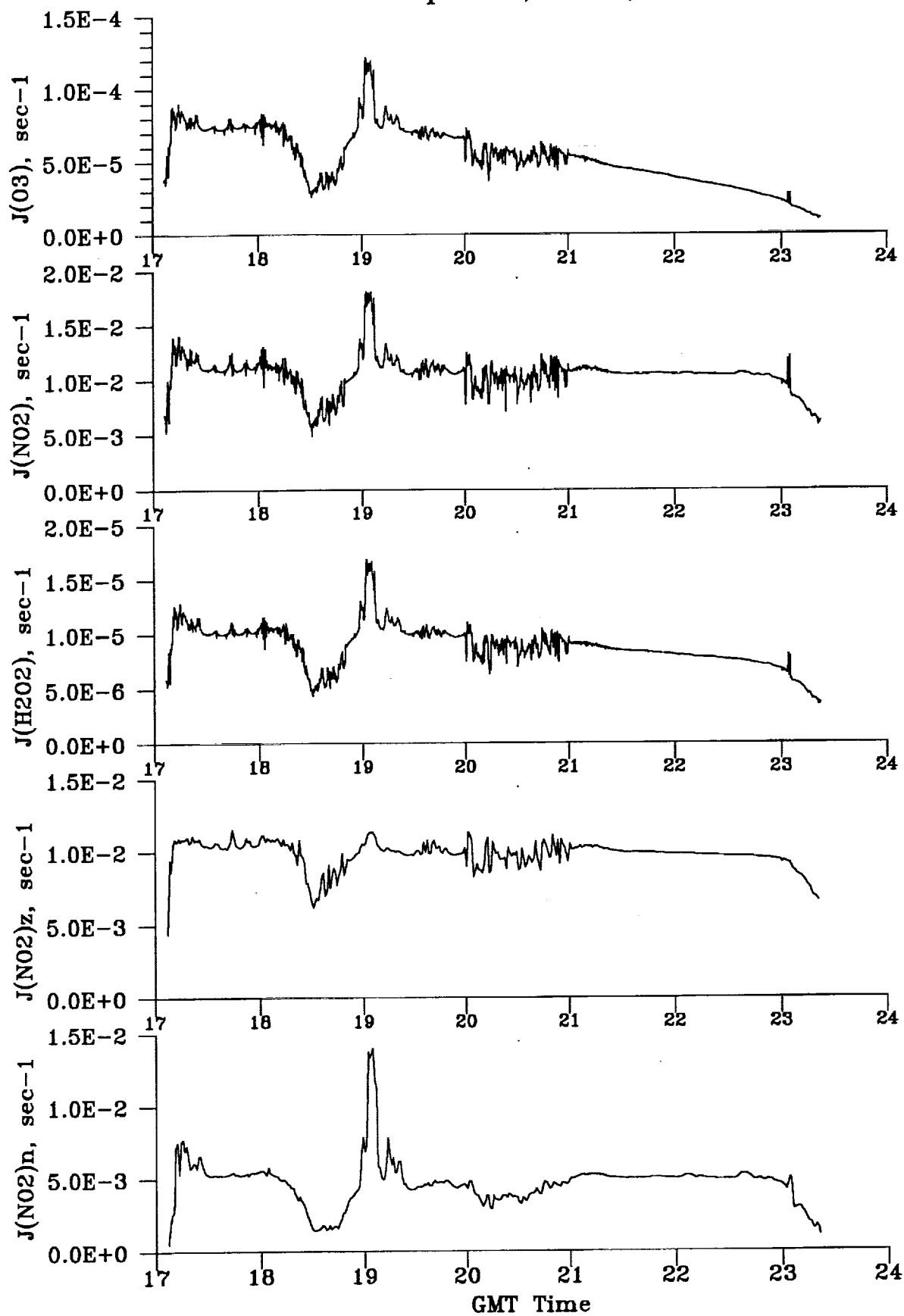
PEM Tropics B; DC-8; FLIGHT 22



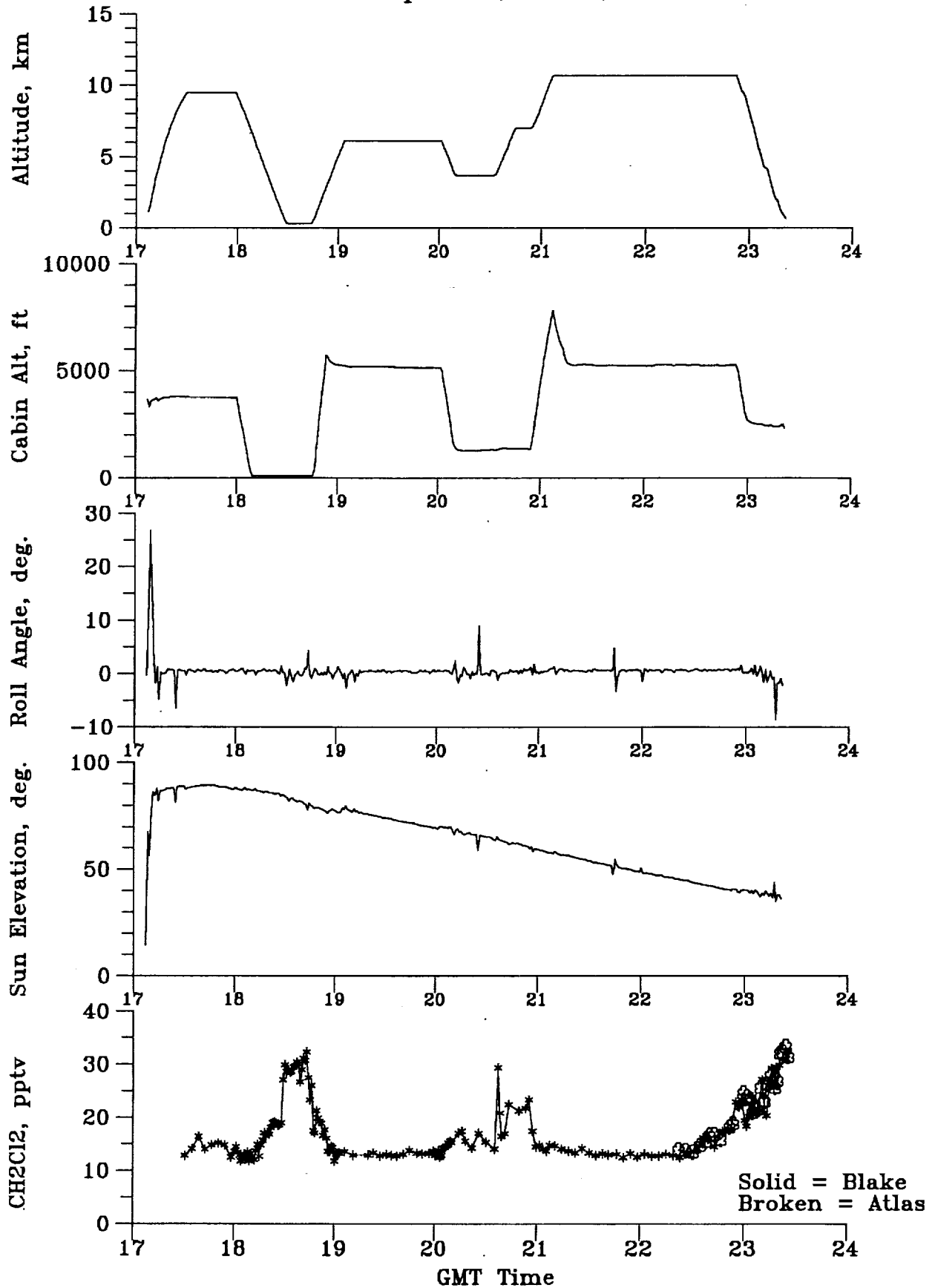
PEM Tropics B; DC-8; FLIGHT 22



PEM Tropics B; DC-8; FLIGHT 22



PEM Tropics B; DC-8; FLIGHT 22



APPENDIX B: LANGLEY DAAC DATA ARCHIVE

System Description

The Langley Distributed Active Archive Center (DAAC), located at the NASA Langley Research Center in Hampton, Virginia, is responsible for archiving and distributing NASA science data in the areas of radiation budget, clouds, aerosols, and tropospheric chemistry. This DAAC will also archive some of the data sets, which result from the EOS program and other elements of the Earth Science Enterprise. The DAAC has developed an on-line computer system, which allows the user to log on, search through the DAAC's data inventory, choose desired data sets, and place an order. Data may be received either electronically (via FTP) or on media such as 4mm tape, 8mm tape, or CD-ROM (prepackaged data sets only).

Log On Procedures

1. Users with an X-Windows terminal (e.g., Motif) or a Sun Open Windows display system with access to Internet, may log onto the system by entering:

xhost + eosdis.larc.nasa.gov

(or: xhost + 192.107.191.17)

telnet eosdis.larc.nasa.gov

login name: ims

password: larcims

At the prompts, enter x for the X-Windows interface and then your display name (name of your workstation followed by ":0" or internet address followed by ":0").

2. Users with access to Netscape or Microsoft Internet Explorer can use the following URL address:

<http://eosdis.larc.nasa.gov/>

3. Users without access to a terminal with an X-Windows display system, but who have access to Internet may log onto the system by entering:

telnet eosdis.larc.nasa.gov

login name: ims

password: larcims

At the prompt, enter c for the character interface and then press return.

4. Users who cannot access the system or who have any questions concerning the Langley DAAC may contact:

Langley DAAC User and Data Services

Mail Stop 157D

NASA Langley Research Center

Hampton, VA 23681-0001

Phone: (757) 864-8656 (M-F 8 am – 8pm, Eastern Time)

FAX: (757) 864-8807

Email: larc@eos.nasa.gov

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13. ABSTRACT (Maximum 200 words) This report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Pacific Exploratory Mission-Tropics B (PEM-Tropics B) conducted in March and April 1999. PEM-Tropics B was conducted during the southern-tropical wet season when the influence from biomass burning observed in PEM-Tropics A was minimal. Major deployment sites were Hawaii, Kiritimati (Christmas Island), Tahiti, Fiji, and Easter Island. The broad goals of PEM-Tropics B were to improved understanding of the oxidizing power of the atmosphere and the processes controlling sulfur aerosol formation and to establish baseline values for chemical species that are directly coupled to the oxidizing power and aerosol loading of the troposphere. The purpose of this document is to provide a representation of aircraft data that will be available in archived format via NASA Langley's Distributed Active Archive Center (DAAC) or are available through the GTE Project Office archive. The data format is not intended to support original research/analysis, but to assist the reader in identifying data that are of interest.				
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